

ADM. REC.

RCRA RECORDS CENTER
FACILITY Ciba Geigy Corp
I.D. NO. R.D. 001194323
FILE LOC. R-13 2b
OTHER #108585

Stabilization Investigation

Former CIBA-GEIGY Facility
Cranston, Rhode Island



RDMS DocID

108585

Revised Final Stabilization Design Documents Technical Specifications

Prepared For:
CIBA-GEIGY Corporation
Route 37 West
Toms River, New Jersey 08754

Prepared By:
Woodward-Clyde Consultants
201 Willowbrook Boulevard
Wayne, New Jersey 07470

Volume 2A of 4

January 1995
Project No. 87X4660D

Stabilization Investigation

Former CIBA-GEIGY Facility
Cranston, Rhode Island

Revised Final Stabilization Design Documents
Technical Specifications

Prepared For:
CIBA-GEIGY Corporation
Route 37 West
Toms River, New Jersey 08754

Prepared By:
Woodward-Clyde Consultants
201 Willowbrook Boulevard
Wayne, New Jersey 07470

Volume 2A of 4

January 1995
Project No. 87X4660D

TABLE OF CONTENTS

VOLUME 2A

Division 1 - GENERAL REQUIREMENTS

01010	-	Summary of Work
01025	-	Measurement and Payment
01026	-	Schedule of Values
01040	-	Coordination
01045	-	Cutting and Patching
01046	-	Connections to Existing Facilities
01050	-	Field Engineering
01091	-	Reference Standards
01120	-	Decontamination of Personnel and Equipment
01200	-	Preconstruction Conference
01210	-	Progress Meetings
01300	-	Submittals
01310	-	Construction Schedules
01380	-	Construction Photographs
01540	-	Protection of the Work and Property
01545	-	Security
01550	-	Access Roads and Parking Areas
01560	-	Environmental Controls
01590	-	Temporary Construction Facilities
01610	-	Storage of Material
01620	-	Installation of Equipment
01630	-	Substitutions
01710	-	Cleaning
01720	-	Record Documents
01730	-	Operation and Maintenance Data
01750	-	Spare Parts and Maintenance Materials

Division 2 - SITE WORK

02060	-	Demolitions and Removals
02220	-	Excavation and Backfill
02545	-	Pavement
02671	-	Soil Vapor Extraction Well Modifications
02672	-	Groundwater Extraction Well Modifications
02800	-	Fencing

Division 3 - CONCRETE

03010	-	Grout
03300	-	Concrete

**TABLE OF CONTENTS
(CONTINUED)**

Division 4 - MASONRY

- 04150 - Masonry Accessories
- 04200 - Unit Masonry Construction

Division 5 - METALS

- 05120 - Structural Steel
- 05500 - Miscellaneous Metal Fabrications
- 05505 - Anchor Bolts, Expansion Anchors and Concrete Inserts
- 05520 - Aluminum Handrails and Railings
- 05535 - Aluminum Grating

Division 6 - WOOD AND PLASTICS

- 06100 - Rough Carpentry
- 06400 - Pre-Engineered Wall Panels

Division 8 - DOORS AND WINDOWS

- 08110 - Hollow Metal Doors and Frames
- 08300 - Overhead Rolling Doors
- 08710 - Door Hardware

Division 9 - FINISHES

- 09880 - Protective Concrete Coatings Concrete Toppings
- 09900 - Painting

Division 10 - SPECIALTIES

- 10200 - Louvers and Vents
- 10400 - Identification Devices

Division 11 - EQUIPMENT

- 11210 - Soil Vapor Extraction System Pumps
- 11214 - Positive Displacement Metering Pumps
- 11222 - Top Entering Mechanical Mixing Equipment
- 11300 - Vertical Submersible Recovery Well Pumps
- 11340 - Soil Vapor Extraction (SVE) System Equipment
- 11350 - SVE Vapor-Phase Treatment System
- 11351 - Horizontal Centrifugal Pumps
- 11373 - Oil/Water Separator

**TABLE OF CONTENTS
(CONTINUED)**

VOLUME 2B

Division 13 - SPECIAL CONSTRUCTION

13120	-	Pre-Engineered Buildings
13121	-	SVE System Trailer and Appurtenances
13200	-	SVE Shop Fabricated Tanks
13201	-	Groundwater Pretreatment System Stainless Steel Tanks
13410	-	General Instrumentation and Control Requirements
13415	-	Functional Specification
13420	-	Miscellaneous Instrumentation and Control Devices
13422	-	Pressure Transmitter - Electronic
13427	-	Level Transmitter - Radio Frequency Impedance
13428	-	Single Point Level Switch
13429	-	Continuous Level Sensor - Ultrasonic
13437	-	Flow Meter - Magnetic
13439	-	Great Lakes Instruments - pH Transmitter
13442	-	Multi-Point Level Switch
13450	-	Control Panels
13451	-	Modicon Programmable Logic Controller
13452	-	Modicon Modbus Plus Bridge/Multiplexer
13455	-	Moore Industries DIN Power Supply
13456	-	ARCOM SHIM-8 HART Interface Unit
13457	-	Eaton IDT Panelmate Video Control Panel
13460	-	Control Program Hardware
13470	-	Wonderware InTouch Man-Machine Interface Software
13480	-	Variable Frequency Drive

Division 15 - MECHANICAL

15051	-	Wall Pipes, Floor Pipes and Pipe Sleeves
15060	-	SVE Piping and Appurtenances
15080	-	Piping Smaller Than 4-Inches in Diameter
15085	-	Valves and Specials Smaller Than 4-Inches in Diameter
15090	-	Piping 4-inches in Diameter and Layer
15095	-	Valves and Specials 4-inches in Diameter and Layer
15120	-	Gas Piping System
15140	-	Pipe Hangers, Supports, and Restraints

**TABLE OF CONTENTS
(CONTINUED)**

15260	-	Piping Insulation
15141	-	SVE System Supports and Anchors
15335	-	Dry Pipe Sprinkler System
15365	-	Portable Fire Protection Equipment
15400	-	Compressed Air Equipment
15550	-	Unit Heaters - Gas Fired
15750	-	Packaged Air Conditioning Units, Thru Wall, Room Type
15850	-	Make-Up Supply Air and Circulation Fans
15880	-	Ductwork and Accessories
15970	-	Automatic Temperature Controls
15980	-	SVE System Instrumentation and Control
15990	-	Testing, Adjusting and Balancing of HVAC System

Division 16 - ELECTRICAL

16010	-	General Provisions
16050	-	Cable Tray
16111	-	Rigid Conduit
16112	-	Flexible Conduits
16120	-	600 Volt Cable
16125	-	Instrumentation Cable
16127	-	Heat Tracing Cable
16130	-	Pull and Junction Boxes
16170	-	Grounding Systems
16440	-	Disconnect Switches
16461	-	Dry Type Transformers
16465	-	Control Stations
16470	-	Lighting and Distribution Panelboards
16480	-	Magnetic Motor Starters
16482	-	Motor Control Centers
16500	-	Lighting Fixtures

APPENDICES

LIST OF APPENDICES

APPENDIX A Operating Manual for the Calgon Activated Carbon Adsorption System

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The following description is provided as a general scope of work for the construction of the Stabilization Action at the former CIBA-GEIGY facility in Cranston, Rhode Island. The summary of work presented in this section is an overall general summary of the CONTRACTOR'S responsibilities, and does not supersede the requirements of any other specific related section.
1. Modify two (2) existing groundwater recovery wells. Provide submersible pumps, piping, valves, instrumentation and a pre-engineered enclosure as shown and specified.
 2. Provide and install a forcemain from the modified recovery wells to the groundwater pretreatment system located in Building No. 15.
 3. Provide and install the forcemain from the Soil Vapor Extraction (SVE) system to the groundwater pretreatment system.
 4. Provide a 6-foot fence around the forcemains and all exposed exterior piping and conduit as shown and specified.
 5. Provide and install an equalization tank, transfer pumps and secondary containment area as shown and specified.
 6. Demolish and remove selected areas of Building No. 15 as shown and specified.
 7. Install the groundwater pretreatment system including all required electrical, structural, equipment, tanks, instrumentation, piping/valves, plumbing, fire protection and HVAC work as shown and specified.
 8. Provide and construct the SVE System including all required electrical, structural, instrumentation, piping, extraction wells and HVAC work as shown and specified.
 9. Provide and install a thermal/catalytic oxidizer for the SVE System.

B. Permits and Regulations:

1. Obtain and pay for all necessary and required permits for the work.
2. Comply with all applicable regulations of OSHA in performance of the work and take all required precautions to insure the safety and health of personnel.

C. Submittals:

Prior to beginning the work, the CONTRACTOR shall submit to the OWNER and ENGINEER for approval, all materials as required in other sections of this document.

D. Hours of Work:

1. Unless permitted by the OWNER, no work shall be performed between the hours of 6:00 pm and 7:00 am.
2. If it becomes absolutely necessary to perform the required work at either night or on weekends, the CONTRACTOR shall inform both the OWNER and the ENGINEER in writing, 24-hours in advance of beginning such work.

1.2 CONTRACTS

- A. The work for this project shall be performed under one prime contract.

1.3 CONTRACTOR'S USE OF THE PREMISES

- A. Coordinate the use of the premises, for storage and the operations of his workmen, with the OWNER Operations and the existing utility service companies.
- B. Provide protection and safekeeping of all equipment and materials on the site. No claim shall be made against the OWNER or his authorized representatives by reason of any act. No materials or equipment may be placed upon the property other than the areas designated by the OWNER to be used for storage.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01010

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of methods measuring and payment for work performed in accordance with the Contract Documents.

1.2 RELATED SECTIONS

- A. General Conditions - Information to Bidders

1.3 DESCRIPTION

- A. The items listed below beginning with Article 1.6, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant, services, CONTRACTOR'S field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, bonds, insurance, and all other requirements of the General Conditions, and other sections. Compensation for all such services, things and materials shall be included in the prices stipulated for the lump sum and unit pay items listed herein.

1.4 ESTIMATE OF QUANTITIES

- A. The estimated quantities for unit bid prices, as listed in the Bid Schedule, are approximate only and are included solely for the purpose of comparison of bids. The OWNER does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as OWNER may deem necessary. CONTRACTOR will not be entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions or deductions caused by a variation in quantities as a result of more accurate measurement, or by any changes or alterations in the Work approved by the OWNER, and for use in the computation of the value of the Work performed of progress payments.

1.5 RELATED PROVISIONS SPECIFIED ELSEWHERE

- A. Payments to CONTRACTOR: Refer to General Conditions and Construction Contract.
- B. Changes in Contract Price: General Conditions
- C. Schedule of Valves: Section 01026

1.6 STABILIZATION ACTION

- A. Measurement and Payment: The lump sum payment for Item 1 will be full compensation for completing the Work as shown and specified under Divisions 1 through 16.

END OF SECTION 01025

SECTION 01026
SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description and requirements of the Schedule of Values.

1.2 DESCRIPTION

- A. The Schedule of Values is an itemized list that establishes the value or cost of each part for the Work. It shall be used as the basis for preparing progress payments and may be used as a basis for negotiations concerning additional work or credits which may arise during the construction. Quantities and unit prices may be included in the schedule when approved by or required by the ENGINEER.

1.3 PREPARATION

- A. The schedule shall show breakdown of labor, materials equipment and other costs used in preparation of the Bid.
- B. The costs shall be in sufficient detail to indicate separate amounts for each Section of the Specifications.
- C. Insurance, temporary facilities and job mobilization may be included. However, these items will be included for payment at a rate spread equally over the entire length of the project.
- D. The Schedule of Values shall be prepared on a standard AIA Form.
- E. Use the Table of Contents of the Specifications as basis for Schedule format and identify each item with number and title in the Table of Contents. List sub-items of major products or systems as appropriate or when requested by ENGINEER.
- F. When requested by ENGINEER, support values with data that will substantiate their correctness.
- G. The sum of the individual values shown on the Schedule of Values must equal the total Contract Price.
- H. Each item shall include a directly proportional amount of the overhead and profit.

- I. The schedule shall show the purchase and delivery costs for materials and equipment that the CONTRACTOR anticipates he shall request payment for prior to their installation.

1.4 SUBMITTAL

- A. Submit two (2) copies of the Schedule of Values to the ENGINEER for approval at least 20 days prior to submitting the first application for a progress payment. After review by ENGINEER, revise and resubmit Schedule as required until it is approved.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01026

SECTION 01040
COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Information on coordination between the general CONTRACTOR, Sub-contractors, CIBA-GEIGY (owner) and the ENGINEER.

1.2 COORDINATION

- A. Provide coordination for all of the Work. Supervise, direct and cooperate fully with all Subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure the completion of the Work.
- B. Provide coordination with the utility service companies or OWNER's employees performing additional work at the site. Coordinate arrangements for storage of materials during execution of the Work, affording them without compensation, reasonable use of facilities under his control necessary for the performance of their work. The CONTRACTOR shall have no claim against the OWNER for delay caused by conflicts with other CONTRACTORS, utility service companies or the OWNER employees which may be operating at the site.
- C. The CONTRACTOR shall not be responsible for damage done by contractors not under his jurisdiction. He will not be liable for any such loss or damage unless it is through his own negligence.
- D. Maintain sufficient competent personnel, drafting equipment and supplies at the site for the purpose of preparing layout and coordination drawings. These drawings shall supplement the Contract Documents, Working Drawings and Shop Drawings as necessary to correlate the work of various trades. Where such drawings are to be prepared by the mechanical, electrical, plumbing, or heating and ventilating Subcontractors, the CONTRACTOR will ensure that each Subcontractor maintains the required personnel and facilities at the site.
- E. The CONTRACTOR shall also coordinate his Work with the work of others to assure compliance with the construction/project schedules.
- F. Participate in all project coordination or progress meetings. Report on the progress of all Work and compliance with schedules.

- G. Conduct all Work to assure compliance with the project schedules. Transmit written instructions to all concerned suppliers and Subcontractors with copies to the OWNER and ENGINEER. Report all conflicts and discrepancies to the ENGINEER in writing.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01040

SECTION 01046
CONNECTIONS TO EXISTING FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Connections and tie-ins to existing facilities (including test pits to locate existing utilities and structures which may be encountered) to complete construction.

1.2 SEQUENCING AND OPERATIONS

- A. Keep existing facilities in operation unless otherwise specifically permitted in these Specifications or approved by the OWNER.
- B. Perform all construction activities as to avoid interference with the operations of the facility and the work of others.
- C. All operations of existing equipment shall be performed by the OWNER, unless specific permission is granted by the OWNER to the CONTRACTOR.
- D. Coordinate all work and schedules and shall provide the OWNER with written notice at least 48-hours before a shut-down is required.
- E. Complete all necessary preparatory Work and keep each shutdown to a minimum.
- F. If Work during any shutdown or interruption period is not done satisfactorily, or as planned, or within the maximum time allocated, OWNER may order CONTRACTOR to place the facilities back in service and reschedule the Work, or he may order the Work required to place the facilities back in service done with other forces. If the Work is done by other forces, OWNER'S costs will be deducted from the amount due to the CONTRACTOR.
- G. No direct payment will be made for any labor, materials, tools, equipment or temporary facilities required for shutdowns. All costs shall be considered to have been included in the prices bid for the Contract.

1.3 SUBMITTALS

- A. Submit to the ENGINEER for Review and Comment a detailed schedule of proposed connections, including time estimate of shut-downs and tie-ins.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01046

SECTION 01050
FIELD ENGINEERING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Land Surveyor requirements for maintaining horizontal and vertical control and record documentation for the Work.

1.2 RELATED SECTIONS

- A. General Conditions.
- B. Section 01720 - Record Documents.

1.3 REFERENCES

- A. Topographical map of the Site.

1.4 SUBMITTALS

- A. Submit to the ENGINEER, for review and comment, name, address, telephone number, and registration number of Surveyor before starting work.

1.5 QUALITY CONTROL

- A. Employ a Land Surveyor, registered in the State of Rhode Island, and acceptable to the ENGINEER to maintain specified horizontal and vertical requirements for the work items.

1.6 RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. On completion of the Work, prepare certified survey drawings illustrating as-constructed dimensions, locations, grades, angles, and elevations of construction and Site Work.
- C. Submit Record Documents in accordance with Section 01720.

1.7 SURVEY REFERENCE POINTS

- A. The ENGINEER will establish a base line and bench mark. Contractor shall establish all other lines required for the Work in accordance with the general conditions.
- B. Protect survey control points prior to starting the Work. Preserve permanent reference points during construction. Replace damaged control and reference points at no additional cost.

1.8 SURVEY REQUIREMENTS

- A. Establish local horizontal and vertical control and reference points for site mapping and Record Documents.
- B. Establish interim controls for line and grade control of the Work as it progresses to assure proper placement of the Work.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01050

SECTION 01045
CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cutting and patching during construction, completed Work and existing facilities to accommodate the coordination of work, work for access, inspection or testing, or similar purposes. "Demolition Work" is specified elsewhere.

1.2 CUTTING AND PATCHING

- A. Execute all cutting and patching as follows:
 - 1. Remove and replace defective Work or Work not conforming to requirements of the Contract Documents.
 - 2. Remove samples of installed Work as required for testing.
 - 3. Remove all constructions required to provide for specified alteration or addition to existing Work.
 - 4. Uncover Work for ENGINEER'S inspection or inspection by regulatory agencies having jurisdiction.
 - 5. Connect to completed Work that was not accomplished in the proper sequence.
 - 6. Remove or relocate existing utilities and pipes which obstruct the Work to which connections must be made.
 - 7. Make connections or alterations to existing or new facilities.
- B. Restore all existing Work to a state equal to that which it was in prior to cutting and restore new Work to the standards of these Specifications.

1.3 SUBMITTALS:

- A. Prior to any cutting which may affect the integrity and design function of the Project, OWNER'S operations, or work of another contractor, submit written notice to the ENGINEER, requesting consent to proceed with cutting, including:
 - 1. Identification of Project.
 - 2. Description of affected Work and work of others.
 - 3. Necessity for cutting.
 - 4. Effect on other work and on structural integrity of location.
 - 5. Description of proposed Work. Designate:
 - a) Scope of cutting and patching.
 - b) CONTRACTOR, Subcontractor or trade to execute Work.
 - c) Products proposed to be used.

- d) Extent of refinishing.
 - e) Schedule of operations.
- 6. Alternatives to cutting and patching, if any.
- 7. Designation of party responsible for cost of cutting and patching.
- B. Should conditions of Work, or schedule, indicate change of materials or methods, submit a written recommendation to the ENGINEER, including:
 - 1. Conditions indicating change.
 - 2. Recommendations for alternative materials or methods.
 - 3. Submittals as required for substitutions.
- C. Submit written notice to the ENGINEER, designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by the ENGINEER.
- D. Provide shoring, bracing and support to maintain the structural integrity and protect adjacent Work from damage during cutting and patching.
- E. Conform to all applicable Specifications for application and installation of materials used for patching.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01045

SECTION 01091
REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reference standards to be used on this project.

1.2 REFERENCE STANDARDS

- A. Comply with the requirements and recommendations of all stated reference standards, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest version of all noted standards shall apply to this Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:

AMCA	-	Air Moving and Conditioning Association, Inc.
ACI	-	American Concrete Institute.
ACIFS	-	American Cast Iron Flange Standards.
AFBMA	-	Anti-Friction Bearing Manufacturers Association.
AGA	-	American Gas Association.
AGMA	-	American Gear Manufacturers Association.
AIA	-	American Institute of Architects.
AISC	-	American Institute of Steel Construction.
AISI	-	American Iron and Steel Institute.
ANSI	-	American National Standards Institute.
ASCE	-	American Society of Civil Engineers.
ASHRAE	-	American Society of Heating, Refrigeration, and Air Conditioning Engineers.
ASME	-	American Society of Mechanical Engineers.
ASTM	-	American Society for Testing and Materials.
AWS	-	American Welding Society.
AWWA	-	American Water Works Association.
CGA	-	Compressed Gas Association.
CRSI	-	concrete Reinforcing Steel Institute.
DIPRA	-	Ductile Iron Pipe Research Association.
EEI	-	Edison Electric Institute.
EJMA	-	Expansion Joint Manufacturers' Association.
FM	-	Factory Mutual.
HMI	-	Hoist Manufacturers' Institute.
IEEE	-	Institute of Electrical and Electronic Engineers.

IPCEA	-	Insulated Power Cable Engineers Association.
NACE	-	National Association of Corrosion Engineers.
NBS	-	National Bureau of Standards.
NEC	-	National Electric Code.
NEMA	-	National Electrical Manufacturers Association.
NFPA	-	National Fire Protection Association.
OSHA	-	Occupational Safety and Health Act.
PCA	-	Portland Cement Association.
PCI	-	Prestressed Concrete Institute.
RMA	-	Rubber Manufacturers' Association.
SMACCNA	-	Sheet Metal and Air Conditioning Contractors National Association.
SPI	-	Society of the Plastics Industry.
SSPC	-	Steel Structures Painting Council.
STI	-	Steel Tank Institute.
UL	-	Underwriters' Laboratory.

- B. When required, furnish evidence satisfactory to the ENGINEER, that the materials and methods used are in accordance with the standards specified.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01091

SECTION 01120
DECONTAMINATION OF PERSONNEL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Labor, materials, and equipment necessary for the decontamination of all personnel, heavy equipment, drilling, driving equipment, sampling equipment, and miscellaneous equipment.

1.2 DECONTAMINATION

- A. Supply all decontamination equipment, facilities, and supplies.
- B. All personnel shall be decontaminated before leaving the site, as specified in the Site Health and Safety Plan.
- C. Equipment shall be cleaned and decontaminated prior to use onsite, and prior to leaving the site.
- D. All equipment shall be washed and cleaned in accordance with the requirements of the Site Health and Safety Plan, and approved by the OWNER's representative prior to initiation of work at the site.
- F. All decontamination water shall be placed in sealed, DOT approved 55-gallon drums and relocated to a location on-site for temporary storage as designated by the ENGINEER. All containers shall be labeled and dated. The CONTRACTOR shall provide all required 55-gallon drums.

1.3 TRANSPORTATION OF HAZARDOUS WASTE

- A. All hazardous waste material shall be transported to an approved TSDF or other USEPA designated site in accordance with all applicable EPA, RCRA, Rhode Island DOT, Federal DOT, or other Federal, State, and local regulations.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all equipment necessary for decontamination, such as clean and distilled water, trisodium phosphate, acetone, methanol, a mobile hot-water high-pressure washer, buckets and brushes, etc.

PART 3 EXECUTION

3.1 GENERAL

- A. Follow the general decontamination plans, as specified in the Site Health and Safety Plan. Prior to mobilization, finalize all personnel-decontamination needs, equipment, and procedures with the ENGINEER.

3.2 EQUIPMENT DECONTAMINATION

- A. Heavy equipment shall be decontaminated prior to arrival on-site and before leaving the project site. Decontamination shall consist of the following:
 - 1. Non-phosphate detergent plus tap water wash.
 - 2. Tap water rinse.
 - 3. 10% nitric acid rinse.
 - 4. Tap water rinse.
 - 5. Hexane (pesticide grade) rinse.
 - 6. Deionized water rinse.
 - 7. Total air dry.
- B. All drilling equipment and materials will be decontaminated prior to any drilling operations and between borings. All tools used for soil sampling and packaging, including split-spoon samplers, sample-cutting knives, etc., will be decontaminated prior to the collection of each sample. Well casing, screens, and fittings are to be delivered to the site in a clean condition and decontaminated onsite in the presence of the ENGINEER.
- C. Decontamination of heavy equipment shall include the following:
 - 1. Scrape and remove all earthen materials from the equipment.
 - 2. Hose down equipment with a portable high-pressure, hot-water washer (steam cleaner).
- D. At a minimum, all heavy equipment tires or support vehicles shall be cleaned with the steam cleaner prior to traveling on any public roads.

3.3 PERSONNEL DECONTAMINATION

- A. Perform personnel decontamination prior to leaving the site. Provide all protective clothing and equipment necessary to comply with the decontamination procedures as specified in the Site Health and Safety Plan.
- B. The following personnel decontamination procedures shall be followed:
 - 1. Remove disposable booties and place in plastic bag for disposal.
 - 2. Wash neoprene boots with detergent solution and rinse with clean water. Remove boots and retain for subsequent reuse.
 - 3. Wash outer gloves in detergent solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal or retain for subsequent reuse.
 - 4. Remove Tyvek or SARNEX coveralls (if used). Take care to prevent the release and dispersion of dusts which may have accumulated on the coveralls during onsite operations and place overalls into a disposable plastic bag.
 - 5. Remove the respirator (if used) and place spent filters into the plastic bag destined for disposal. Place the respirator onto a reusable table or into a separate plastic bag for later cleaning and disinfection.
 - 6. Remove disposable gloves.
 - 7. Thoroughly wash hands and face.
 - 8. If concentrations reach Level C, disposable items that were onsite will be placed in a 55-gallon drum with other solid wastes for eventual disposal.

END OF SECTION 01120

SECTION 01200
PRE-CONSTRUCTION CONFERENCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Information on date, time, location required attendance and agenda for the Pre-Construction Conference.

1.2 PRE-CONSTRUCTION CONFERENCE

- A. Conference will be held after execution of the Contract and before construction is started. The ENGINEER will set the date, time and location of the Pre-Construction Conference.
- B. The ENGINEER shall prepare the agenda, preside at meeting, prepare and distribute a transcript of proceedings to all parties.
- C. CONTRACTOR shall provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda.

1.3 REQUIRED ATTENDANCE

- A. OWNER, or OWNER'S REPRESENTATIVE.
- B. ENGINEER.
- C. CONTRACTOR and suppliers.

1.4 AGENDA

- A. The meeting agenda will include, but will not be limited to, the following:
 - 1. Designation of responsible personnel.
 - 2. Subcontractors.
 - 3. Coordination with other contractors.
 - 4. Construction schedule.
 - 5. Processing of Shop Drawings and distribution of Submittals.
 - 6. Processing of field decisions and Change Orders.
 - 7. Requirements for copies of Contract Documents.
 - 8. Insurance in force.
 - 9. Schedule of Values.

10. Processing and Schedule of Payments.
11. Use of premises.
12. CONTRACTOR responsibility for Health & Safety and first aid procedures.
13. Security.
14. Housekeeping.
15. Field Offices.
16. Record Drawings.
17. Any other project related items.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01200

SECTION 01210
PROGRESS MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Information on monthly progress meetings during construction

1.2 PROGRESS MEETINGS

- A. Date and Time:
 - 1. Regular Monthly Meetings: As mutually agreed upon by ENGINEER and CONTRACTOR.
- B. Place: CONTRACTOR'S field office at the Project Site or another mutually agreed upon location.
- C. ENGINEER shall prepare agenda, preside at meetings, and prepare and distribute a transcript of proceedings to all parties.
- D. CONTRACTOR shall provide data required and be prepared to discuss all items on agenda.

1.3 MINIMUM ATTENDANCE

- A. CONTRACTOR, other contractors, and suppliers. Representatives present for each party shall be authorized to act on their behalf.
- B. ENGINEER.
- C. OWNER's Representative.
- D. Others as appropriate.

1.4 AGENDA

- A. Agenda will include, but will not necessarily be limited to, the following:
 - 1. Transcript of previous meeting.
 - 2. Progress since last meeting.
 - 3. Planned progress for next period.
 - 4. Shop Drawings.

5. Problems, conflicts and observations.
6. Change Orders.
7. Applications for payment.
8. Quality standards and control.
9. Schedules, including off-site fabrication and delivery schedules. Corrective measures required.
10. Coordination between parties.
11. Health and Safety Issues.
12. Other business.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01210

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General requirements for submitting coordinated shop drawings, product data, and samples prior to commencing with the Work, and responsibilities for preparation and review of the submittals.

1.2 RELATED SECTIONS

- A. General Conditions.

1.3 SHOP DRAWINGS

- A. General

- 1. Submit working drawings, test reports, and data on materials (hereinafter in this Section called data), and material samples (hereinafter in this Section called samples) as required for the proper control of Work, including but not limited to those working drawings, data, and samples for materials specified elsewhere in the Specifications and on the Drawings.

- B. Contractor's or subcontractor's Drawings made specifically for this Work

- 1. Shop drawings shall provide sufficient data, including layout, fabrication, and erection details to establish evidence of compliance with the Contract Documents.
- 2. Do not use reproductions of Contract Drawings as shop drawings.
- 3. Identify details by reference to sheet and detail numbers shown on the Drawings and by reference to paragraphs of Specification section.

- C. Manufacturer's Standard Schematic Drawings

- 1. Modify drawings to delete information which is not applicable to Work. Drawings showing information which is not applicable will be returned without review.
- 2. Add supplemental information applicable to Work.

1.4 PRODUCT DATA

A. Manufacturer's Catalog Sheets, Brochures, Diagrams, Schedules, Performance Charts, Illustrations, and Other Standard Descriptive Data.

1. Clearly mark each copy to identify materials, products, or models applicable to this project. Submittals not marked shall be returned without review.
2. Where product data is printed in color and requires color for evaluation, all copies submitted shall be in original colors as published.
3. Show dimensions and clearances required.
4. Show performance, characteristics, and capacities.

1.5 SAMPLES

A. Samples of products proposed for use shall be submitted and of sufficient size and quantity in accordance with individual specification sections.

1.6 SUBMITTAL REQUIREMENTS

- A. Submit layout, detail, and shop drawings in accordance with this section. When a submittal is requested to the Engineer, submit a copy of the transmittal cover letter to the Owner.
- B. Do not combine submittals of more than one (1) product or specification section.
- C. Submit four (4) complete sets of copies of each shop drawing and product data in addition to those required by the Contractor.
- D. Submittals shall include the following information:
1. Relation to adjacent materials.
 2. Field dimensions, clearly identified as such.
 3. Finishes.
 4. Shipping weights.
 5. Gauges, fastenings, reinforcements, welding details.

6. Applicable standards, such as ASTM or Federal Specification numbers.
7. A blank space, 3 inches x 10 inches for the Engineer's stamp.

- E. Contractor's stamp, initialed or signed, shall certify its approval of the submittal that verification of field measurements, coordination with all trades involved, and compliance with Contract Documents has been accomplished. Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Engineer's approval of shop drawings, product data or samples unless the Contractor has specifically informed the Engineer, in writing, of such deviation at the time of submission and the Engineer has given written approval to the specific deviation. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data, or samples by the Engineer's approval thereof.
- F. Substitutions for "or equal" products shall be as follows: "Any other additional cost incurred by the Owner or to any other Contractor as a result of the proposed substitution of equipment and/or material shall be borne by the Contractor who has proposed the substitution".

1.7 ENGINEER'S RESPONSIBILITIES

- A. If Contractor does not review submittals before sending them to the Engineer, they will be returned unchecked.
- B. Review submittals and return within two (2) weeks of their receipt.
- C. Review for conformance to design concept of Work and information in Contract Documents. Review of separate items does not constitute review of an assembly in which item functions.
- D. Affix stamp and date certifying review of submittals.
- E. Return submittals to Contractor with approval or directions to correct and re-submit.
- F. The Engineer's action on submittals will result in the making of one of the following notations with related meanings:
 1. APPROVED - The work involved may proceed, and no further submission is required.

2. **APPROVED - SUBJECT TO CORRECTIONS MARKED** - The work involved may proceed providing submittal is corrected and resubmitted for record. Approval does not authorize changes to Contract Sum unless stated in a separate letter or Change Order. In the event any comment made to the submittal by the Engineer results in a change in the Contract Sum, the Engineer shall be notified immediately and fabrication may not be undertaken until written authorization to proceed is issued.
3. **EXAMINED AND RETURNED FOR CORRECTION** - The work involved may not proceed. Submittal must be corrected/redrawn and resubmitted.

1.8 RE-SUBMITTAL REQUIREMENTS

- A. Identification of Changes - Clearly identify changes made from the initial submittal other than those requested by the Engineer. The Engineer will review only those changes he requested and those identified by the Contractor.
- B. Make re-submittals as specified in paragraph 1.6 of this Section.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01300

SECTION 01310
CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordinated preparation, submittal, review, and maintenance of a construction schedule and monthly progress reports.

1.2 RELATED SECTIONS

- A. General Conditions.
- B. Section 01300 - Submittals.

1.3 SUBMITTALS

- A. Submit to the Engineer for review and comment, within 10 days after the notice to proceed, three (3) copies of a preliminary progress schedule covering operations for the first 30 days. The preliminary progress schedule shall be a bar graph or an arrow diagram showing the times for start and completion of the various work planned to be started during the first 30 days.
- B. Submit to the Engineer for review and comment, within 10 days after the notice to proceed, three (3) copies of a critical path-type analysis. The critical path-type analysis shall include a graphic network diagram, list of activities, and a brief written explanation of the proposed schedule. Submit two activity listings in two formats: sorted by activity number; sorted by total float then early start.
- C. Submit updated monthly progress schedules with that months' Request for Payment to the Engineer for review and comment.

1.4 CONSTRUCTION SCHEDULE

- A. The graphic network diagram shall consist of an arrow diagram, precedence diagram, or a geometric figure and connector diagram which clearly depicts the order and interdependencies of activities planned by the Contractor as well as activities by others which effect the Contractor's planning. Show the intended time for starting and completing each activity, the associated float time, and the quantity and kinds of major equipment to be used for each construction operation.
- B. For those activities lasting more than 30 days, show either the estimated time for

25-, 50-, and 75-percent completion, or other significant milestones in the course of the activity. In addition to the actual construction operations, the network diagram shall show such items as submittal of samples and shop drawings, delivery of materials and equipment, construction in the area by other forces, and other significant items related to the progress of the construction. The graphic network diagram shall be printed neatly and legibly drawn to a time scale.

- C. Activities shown shall be coordinated with the Contractor's bid items. Show types of work and minimum number of activities of each type.
- D. Show for each activity the identification number, activity description, duration, the earliest starting and finishing dates, the latest starting and finishing dates, and the float or slack time. Identify activities which constitute the critical sequence whose float is zero.
- E. Include sufficient information to describe the construction methods to be used to enable the Engineer to evaluate the schedule and supporting analysis for validity and practicality. If the schedule or written explanation is not accepted by the Engineer, re-submit in accordance with Section 01300.

1.5 MONTHLY PROGRESS REPORTS

- A. Monthly progress reports shall list those uncompleted activities which have less than 90 days float and which are either in progress or scheduled to be started within the next reporting period. For each of the listed activities, show the following:
 - 1. Early and late start and finish.
 - 2. Actual start date.
 - 3. Total float.
 - 4. Activity description.
- B. If the noted starting dates or durations delay the scheduled project completion date, the delay shall be noted. Give reasons for delay with an explanation of the Contractor's proposed corrective action. Note each activity completed during the report period.

1.6 REVISIONS

- A. Submit a revised critical path-type analysis when one or more of the following conditions occur:

1. When a change order significantly affects the Contract completion date or the sequence.
2. When progress of any critical activity falls significantly behind the scheduled progress.
3. When delay on a non-critical activity is of such magnitude as to change the course of the critical path.

B. Submit the revised analysis in the same form and detail as the original submittal with explanation of the reasons for the revisions.

1.7 PROSECUTION OF WORK

- A. Prosecute the Work in accordance with the latest critical path-type analysis. Deviations therefrom shall be submitted to the Engineer for review. In the event that the progress of items along the critical path is delayed, revise planning to include additional force, equipment, shifts, or hours as necessary to meet the Contract completion date. All additional costs resulting therefrom will be borne by the Contractor.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01310

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Periodic photographs recording the progress of the work.

1.2 PHOTOGRAPHY

- A. Retain a qualified professional photographer to perform the services specified in this Section.
- B. Pay for the photographer's services and supplies for the duration of the Project.
- C. Provide access, health, and safety equipment and supplies as required to the photographer for the duration of the Project.

1.3 PROJECT PHOTOGRAPHS

- A. Record the important features of the site prior to the commencement of work, during construction, and after the work has been completed.
- B. Before work begins, take a minimum of 50 views, including but not limited to, views of the site locations of the future pretreatment plant, and areas of excavation. The locations will be designated by the ENGINEER.
- C. Take progress photographs throughout the project.
- D. The progress photographs shall be 4 x 6 inches.
- E. The progress photographs shall include, but not be limited to coverage of the following:
 - 1. Initial and completed views of the general site conditions.
 - 2. Future and existing recovery well locations.
 - 3. Temporary/final fencing.
 - 4. Easements, staging area and access roads.
 - 5. Temporary construction facilities.
 - 6. Decontamination of personnel and equipment.
 - 7. Groundwater Capture System.
 - 8. Pretreatment System.

9. Soil Vapor Extraction System Construction.
10. Utility trench.
11. Civil, electrical, structural, instrumentation and HVAC progress intervals.
12. Final site clean-up and restoration.
13. Unanticipated events.

F. After completion of the work, the shall take a minimum of 50 views. Total project photographs shall be 300 views.

1.4 VIEWS REQUIRED

- A. Prints will illustrate condition and location of work and the state of progress.
- B. At successive periods of photography, the CONTRACTOR shall take at least one photograph from the same overall view as previously required.
- C. Consult with the ENGINEER at each period of photography for recommendations concerning views required.

1.5 DELIVERY OF PRINTS

- A. The CONTRACTOR shall submit to the ENGINEER two (2) prints of each photograph taken prior to the commencement of work and after the completion of work, along with the negatives within ten (10) calendar days after taking the photographs, or as approved by the ENGINEER.
- B. The CONTRACTOR shall submit to the ENGINEER two prints of each progress photograph along with the negatives within ten (10) calendar days after taking the photographs or as approved by the ENGINEER.
- C. All photographs are the OWNER's property and will not be released to the public or news media by the CONTRACTOR, SUB-CONTRACTOR or any others. The photographs should be enclosed back-to-back in a double-face plastic sleeve punched to fit standard three-ring binders.

1.6 PRINTS

- A. All prints shall be color.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01380

SECTION 01540
PROTECTION OF THE WORK AND PROPERTY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Precautions and programs to protect the Work and all public, private property and facilities from damage.

1.2 PROTECTION OF WORK

- A. In order to prevent damage, injury or loss, CONTRACTOR'S actions shall include, but not be limited to, the following:
 - 1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the Work of any other Contractor or utility service company.
 - 2. Provide suitable storage facilities for all materials which are subject to injury by exposure to weather, theft, breakage, or otherwise.
 - 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
 - 4. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the Work shall present a safe, orderly and workmanlike appearance.
 - 5. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other hazardous areas.
- B. Do not, except after written consent from the proper parties, enter or occupy with people, tools, materials or equipment, privately-owned land except on easements approved by the ENGINEER.

- C. Assume full responsibility for the preservation of all public and private property or facility on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect or misconduct in the execution of the Work by the CONTRACTOR, it shall be restored by the CONTRACTOR, at his expense, to a condition equal to that existing before the damage was done.
- D. Following completion of the Work, damages to curbs, sidewalks, driveways, lawns, shrubbery, monuments or other property caused by CONTRACTOR, shall be repaired at the CONTRACTOR'S expense in a manner acceptable to the ENGINEER. The CONTRACTOR may take photographs to document damage which existed prior to construction.
- E. CONTRACTOR shall submit to the ENGINEER lists of damages to property that exist prior to construction or construction related activity. The lists shall be submitted in the sequence with the construction progress and shall be submitted sufficiently in advance for ENGINEER to verify the damages. The lists shall include the following information:
1. Location of damage.
 2. Nature of damage.
 3. Extent of damage.
- F. CONTRACTOR shall expeditiously and satisfactorily resolve all claims and complaints arising as a result of Work under this Contract. CONTRACTOR shall provide the services of an authorized representative during normal working hours for the purpose of handling all such claims and complaints. A file shall be maintained to log all claims and complaints and shall include the date and time, name of person filing the claim or complaint, nature and extent of the claim or complaint and its resolution. CONTRACTOR must advise ENGINEER monthly in writing of all such claims and complaints received by him including the status of

each, and for each claim or complaint that has been secured by his insurance company, proof that such has been done.

- G. CONTRACTOR shall pay for all costs to handle and resolve any claims or complaints. If, within 90 days of receipt of a complaint, CONTRACTOR fails to settle or secure any claim or complaint, as determined by ENGINEER, OWNER may retain such amounts of money from payments that would otherwise be due CONTRACTOR as, in the opinion of OWNER, may be required to settle all claims filed with OWNER.

1.3 BARRICADES AND WARNING SIGNALS

- A. Where Work is performed on or adjacent to any roadway, right-of-way, or public place, CONTRACTOR shall furnish and erect barricades, fences, lights, warning signs, and danger signals, and shall take other precautionary measures for the protection of persons or property and of the Work. Barricades shall be painted to be visible at night.

1.4 PROTECTION OF EXISTING STRUCTURES

- A. Underground Structures:
 - 1. Underground structures are defined to include, but not be limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical conduits, tunnels and other existing subsurface work located within or adjacent to the Contract limits.
 - 2. Underground structures known to ENGINEER except water, sewer, electric and telephone service connections are shown on the Drawings. This information is shown for the assistance of CONTRACTOR in accordance with the best information available, but is not guaranteed to be correct or complete.
 - 3. CONTRACTOR shall explore ahead of his trenching and excavation Work and shall uncover all obstructing underground

structures sufficiently to determine their location, to prevent damage to them and to prevent interruption to the services which such structures provide. If CONTRACTOR damages an underground structure, he shall restore it to original condition at his expense.

4. Necessary changes in the location of the work may be made by ENGINEER, to avoid unanticipated underground structures.
5. If permanent relocation of an underground structure or other sub-surface facility is required and is not otherwise provided for in the Contract Documents, ENGINEER will direct CONTRACTOR in writing to perform the Work, which shall be paid for under the provisions of the General Conditions.

B. Surface Structures:

1. Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

C. Protection of Underground and Surface Structures:

1. CONTRACTOR shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure. Before proceeding with the work of sustaining and supporting such structure, CONTRACTOR shall satisfy ENGINEER that the methods and procedures to be used have been approved by the party owning same.

2. CONTRACTOR shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits to the Work. CONTRACTOR shall be responsible for all damage and expense for direct or indirect injury caused by his Work to any structure. CONTRACTOR shall repair immediately all damage caused by his work, to the satisfaction of the owner of the damaged structure.

D. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers, and curbs which are temporarily removed to facilitate installation of the Work shall be replaced and restored to their original condition at CONTRACTOR'S expense.

1.5 PROTECTION OF FLOORS AND ROOFS

A. CONTRACTOR shall protect floors and roofs during entire construction period.

B. Proper protective covering shall be used when moving heavy equipment, handling materials or other loads, when painting, handling mortar and grout and when cleaning walls and ceilings.

C. Use metal pans to collect all oil and cuttings from pipe, conduit, or rod threading machines and under all metal cutting machines.

D. Concrete less than 28 days old shall not be loaded without written permission of the ENGINEER. No floor, roof or slab shall be loaded in excess of its design loading.

E. Roofs shall not be loaded without written permission of the ENGINEER.

F. CONTRACTOR shall restrict access to roofs and keep clear of existing roofs except as required by the new Work.

- G. If access to roofs is required, roofing, parapets, openings and all other construction on or adjacent to roof shall be protected with suitable plywood or other approved means.

1.6 PROTECTION OF INSTALLED PRODUCTS AND LANDSCAPING

- A. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
- B. Control traffic to prevent damage to equipment, materials and surfaces.
- C. Provide coverings to protect equipment and materials from damage.
 - 1. Cover projections, wall corners, and jambs, sills and soffits of openings, in areas used for traffic and passage of products in subsequent work.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01540

SECTION 01545
SECURITY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Protection of all Work, materials, equipment and property from loss, theft, damage and vandalism.

1.2 SECURITY

- A. Safely guard property, including the OWNER'S property, and other private property from injury or loss in connection with the performance of the Contract.
- B. Employ watchmen as needed to provide the required security and prevent unauthorized entry.
- C. Make no claim against the OWNER for damage resulting from trespass.
- D. Party responsible for security shall make good all damage to property of OWNER and others arising from failure to provide adequate security.
- E. If existing fencing or barriers are breached or removed for purposes of construction, CONTRACTOR shall provide and maintain temporary security fencing equal to the existing in a manner satisfactory to the ENGINEER and OWNER.
- F. Maintain security program throughout construction and occupancy precludes need for CONTRACTOR'S security program.

1.3 CONTRACTOR'S ACCESS TO THE SITE

- A. The CONTRACTOR shall provide a uniformed guard to control movement to and from the site. The guard shall be provided continuously between the hours of 5:00 p.m. and 7:00 a.m., Monday through Friday, for the duration of this Contract. No separate payment shall be made for the services of the uniformed guard. It is the responsibility of the CONTRACTOR to insure that the Gate not be left unguarded at any time during the hours stated above. If access is required by the CONTRACTOR at times other than that specified above, the CONTRACTOR shall furnish a uniformed guard as required. The cost of this extra uniformed guard service shall be borne by the CONTRACTOR.
- B. Access to the site for CONTRACTOR'S employees, material, tools and equipment shall be only through the Main Gate.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01545

SECTION 01550
ACCESS ROADS AND PARKING AREAS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide all temporary construction roads, walks and parking areas required beyond the designated available space during the construction and for use of emergency vehicles.

1.2 ACCESS ROADS AND PARKING

- A. Temporary roads and parking areas shall be designed and maintained by CONTRACTOR so as to be fully usable in all weather conditions.
- B. Prevent interference with traffic and OWNER'S operations on existing roads. Contractor shall indemnify and hold harmless the OWNER from any expenses caused by CONTRACTOR'S operations over these roads.
- C. Roadways damaged by CONTRACTOR shall be restored to their original condition by CONTRACTOR subject to approval of the OWNER or ENGINEER.
- D. Temporary roads, walks and parking areas shall be removed by CONTRACTOR prior to final acceptance and the ground returned to its original condition, unless otherwise required by the Contract Documents.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01550

SECTION 01560
ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Methods, equipment, and temporary construction, to provide controls over environmental conditions at the construction site and adjacent areas.

1.2 NOISE CONTROL

- A. CONTRACTOR'S vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the Work.

1.3 DUST CONTROL

- A. Control objectionable dust caused by operation of vehicles and equipment, clearing or for any reasons. Dust control methods shall be approved by the ENGINEER.

1.4 PEST AND RODENT CONTROL

- A. Provide rodent and pest control (as necessary) to prevent infestation of construction and/or storage area.
 - 1. Employ methods and use materials which will not adversely affect conditions at the Site or on adjoining properties.

1.5 WATER CONTROL

- A. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the Site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.
- B. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

- C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the Site or to adjoining areas and in conformance with all environmental requirements.

1.6 POLLUTION CONTROL

- A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
 - 1. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
- C. Take special measures to prevent harmful substances from entering public waters.
 - 1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, rivers, sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of pollutants into the atmosphere.
- E. CONTRACTOR'S equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.7 EROSION CONTROL

- A. Plan and execute construction work and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.
 - 2. Provide temporary control measures such as berms, dikes and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01560

SECTION 01590
TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary construction facilities that are required for the completion of the Work.

1.2 TEMPORARY FACILITIES

- A. Provide all arrangements with utility service companies (except for electricity) for temporary services.
- B. Temporary construction facilities that are CONTRACTOR'S responsibility include:
1. Water.
 2. Telephone.
 3. Heat, Weather Protection and Ventilation.
 4. Fire Protection.
 5. Sanitary and First Aid Facilities.
 6. Lighting.
- C. Abide by all rules and regulations of the utility service company or authority having jurisdiction.
- D. Sufficient temporary heat and ventilation shall be provided to assure safe working conditions and that no damage will occur to any of the Work. In addition, all enclosed areas of the building in which the Work is performed shall be maintained at a minimum of 50°F, unless otherwise specifically excepted in the Specifications.
- E. Provide all materials and equipment required for distribution of temporary electricity and lighting. Include continuous power for construction site offices. Provide all outlets with circuit breaker protection and comply with ground fault protection requirements of OSHA and NEC. Minimum lighting shall be 5 foot candles for open areas, 10 foot candles for stairs and shops. Provide minimum of one 300 watt lamp for each 400 square feet on 20 foot centers in Work areas. OWNER'S electrical services will be made available for temporary power and lighting as follows:
1. 100 ampere, 480 volt, 3 phase service terminated at a disconnect switch in the vicinity of the pretreatment system construction area.

- F. Suitably enclosed chemical or self-contained toilets shall be provided for the use of the persons employed on the Work. Toilets shall be located near the Work site and secluded from observation insofar as possible. Toilets shall be serviced at regular intervals, kept clean and supplied throughout the course of the Work.
- G. Furnish and maintain a safe drinking water supply readily available to all workers.
- H. CONTRACTOR shall be responsible for all utility service costs until the Work is substantially complete. Included are all fuel, heat and other utility services necessary for execution, completion, testing and initial operation of the Work.
- I. CONTRACTOR shall:
 - 1. Comply with all applicable requirements specified in Divisions 15 and 16.
 - 2. Maintain and operate the temporary systems to assure continuous service.
 - 3. Modify and extend systems as Work progress.
 - 4. Completely remove temporary materials and equipment when their use is no longer required.
 - 5. Clean and repair damage caused by temporary installations or use of temporary facilities.
 - 6. Restore existing facilities used for temporary services to specified or to original condition. This includes restoration of lawns to areas where staging was performed.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 10590

SECTION 01610
STORAGE OF MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Storage and protection of materials in accordance with manufacturer's recommendations and requirements of Specifications.

1.2 STORAGE OF MATERIALS

- A. Make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, materials and equipment to be incorporated into the Work shall be placed in a location so as not to injure any part of the Work or existing facilities. Provide free access at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants and occupants. Arrange storage in a manner to provide easy access for inspection.
- B. Areas available on the construction site for storage of material and equipment shall be or approved by the ENGINEER.
- C. The ENGINEER reserves the option to require the CONTRACTOR to vacate an assigned storage area with 60 days notice. The ENGINEER shall designate another storage area of equivalent size for use of the CONTRACTOR.
- D. Materials and equipment which are to become the property of the OWNER shall be stored to facilitate their inspection and insure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed in inside storage areas unless otherwise acceptable to ENGINEER.
- E. Lawns, grass plots or other private property shall not be used for storage purposes without the written permission of the ENGINEER or other person in possession or control of such premises.
- F. CONTRACTOR shall be fully responsible for loss or damage of stored materials and equipment.

- G. Do not open manufacturers' containers until time of installation unless recommended by the manufacturer or otherwise specified.
- H. Do not store products in areas under construction unless approved in writing by the ENGINEER.

1.3 UNCOVERED STORAGE

- A. The following types of materials may be stored out-of-doors without cover:
 - 1. Masonry units.
 - 2. Reinforcing steel.
 - 3. Structural steel.
 - 4. Piping.
 - 5. Castings.
- B. Store the above materials on wood blocking so there is no contact with the ground.

1.4 COVERED STORAGE

- A. Rough lumber may be stored out-of-doors if covered with materials impervious to water.
- B. Provide tie down covers with rope and slope to prevent accumulation of water on covers.
- C. Store materials on wood blocking.

1.5 FULLY PROTECTED STORAGE

- A. Store all products not listed above in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.
- B. Provide heated storage space for materials that would be damaged by freezing.
- C. Protect mechanical and electrical equipment from contamination by dust, dirt and moisture.

- D. Maintain humidity at levels recommended by manufacturers for electrical and electronic equipment.

1.6 PANEL AND INSTRUMENTATION STORAGE

- A. All panels, microprocessor based equipment and all other devices subject to damage or useful life decrease because of temperatures below 40°F or above 120°F, relative humidity above 90 percent, or exposure to rain shall not be stored on site.
- B. Storage shall be in an insured climate-controlled warehouse. The OWNER shall have the right to inspect the equipment during normal working hours. Placed inside each panel or device shall be desiccant, volatile corrosion inhibitor blocks (VCI), a moisture indicator and maximum-minimum indicating thermometer. The panels and equipment shall be checked once per month. The desiccant, VCI and moisture indicator shall be replaced as often as required or every six months whichever occurs first. A certified record of the daily maximum and minimum temperature and humidity in the warehouse shall be available for inspection by the OWNER. A certified record of the monthly inspection noting maximum and minimum temperature for the month, condition of desiccant, VCI and moisture indicator shall also be available for inspection by the OWNER.
- C. All costs for the storage shall be included in the Contract Price. Any panel or device which has been damaged by any cause or for which the storage temperatures or humidity range has been exceeded shall be replaced at no cost to the OWNER and shall not be cause for a delay in Contract completion.
- D. The panels and equipment shall not be shipped to the plant site until field conditions are ready for installation including all slabs, walls, roofs, and environmental controls. The failure to have the plant site ready for installation shall not relieve the CONTRACTOR from meeting all Contract conditions.

1.7 MAINTENANCE OF STORAGE

- A. Maintain periodic system of inspection of stored products on a scheduled basis to assure that:
 - 1. State of storage facilities is adequate to provide required conditions.
 - 2. Required environmental conditions are maintained on continuous basis.
 - 3. Products exposed to elements are not adversely affected.

B. Mechanical and electrical equipment which requires long-term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Comply with manufacturer's instructions on scheduled basis.
2. Space heaters which are part of the electrical equipment shall not be connected and operated continuously until equipment is placed in service.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01610

SECTION 01620
INSTALLATION OF EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Installation of OWNER purchased equipment and materials to be incorporated into this project. This section supplements the Specification requirements presented in Divisions 2 through 16.

1.2 SHOP DRAWINGS

- A. Shop Drawings, installation drawings and instructions furnished by the manufacturers shall be used by the CONTRACTOR in the installation of the equipment and materials.

1.3 ANCHOR BOLTS AND GROUT

- A. Anchor and expansion bolts shall be furnished by the CONTRACTOR, as specified and required. Use expansion bolts only where shown or approved by ENGINEER. Anchor and expansion bolts shall be of specified materials with heavy hexhead nuts. Anchorage items shall conform to the applicable requirements of Section 05505.
- B. Grouting shall be in accordance with Section 03010.

1.4 TRANSPORTING, HANDLING AND INSTALLING EQUIPMENT AND MATERIALS

- A. Conform to requirements of Division 1.
- B. Employ competent mechanics experienced in the installation of the types of equipment and materials to be furnished, and shall ensure that all equipment and materials are installed in accordance with the recommendations of the manufacturer.
- C. All bolts, nuts and other fastenings shall be furnished by CONTRACTOR, and shall comply with the applicable requirements of Section 03250.

1.5 EQUIPMENT ERECTION

- A. General: Conform to the following as a minimum.

1. Use only mechanics skilled in the handling, setting, aligning, leveling and adjusting of the type of equipment and materials furnished.
2. Use only an oil bath heater to expand couplings, gears, etc. Do not force or drive them on equipment shafts, nor subject them to an open flame or torch.
3. Wedging will not be permitted. Use least number of flat shims possible in leveling equipment. Shims shall be clean and free of slags. All shims, filling pieces, keys, packing red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be provided. When requested by ENGINEER, demonstrate that all elements are level and plumb. Grind as necessary to bring parts to proper bearing after erection.
4. Use proper tools in the assembly of equipment and materials to prevent deforming or marring the surface of shafts, nuts or other parts.
5. Connections requiring gaskets shall be tightened evenly all around to ensure uniform stress over the entire gasket area.
6. No equipment and materials shall be altered or repaired, and no burning or welding will be permitted on any parts having machined surfaces, except by written permission of the ENGINEER.
7. No rigging shall be done from any structure without the permission of the ENGINEER. The CONTRACTOR shall be completely responsible for damage to the structure resulting from his operations.
8. Use tools, equipment and materials that will not damage the structure or equipment.
9. Furnish and install plugs in lubrication holes to prevent entry of foreign material.
10. Electrical work, testing, lubricating and painting shall all comply with the requirements of Division 16.

B. Setting and Erection:

1. All units shall be carefully set and aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved by the ENGINEER, the bedplates or wing feet of the equipment shall be further checked after securing to the foundations and, after confirmation of all

alignments, the sole plates shall be finally grouted in place. CONTRACTOR shall be responsible for the correct alignment of equipment with its associated piping. "Pipe springing" will not be allowed.

2. Misaligned holes shall be reamed. "Driving" of bolts or keys will not be permitted.

C. Alignment and Leveling:

1. All shafts, couplings and sheaves shall be field checked for alignment and adjusted to manufacturer's specifications where necessary.
2. Couplings shall be aligned while the equipment is free from all external loads.
3. Angular and parallel alignment shall be checked, and the actual alignment shall be recorded and submitted to the ENGINEER. Alignment shall be within manufacturer's recommended tolerance.
4. Dial indicators shall be used for the checking of angular and parallel alignment. During rotation of the half couplings in performance of this test, they shall be maintained in the same relative position, and the dial indicator readings shall be taken at the same place on the circumference of the coupling.

D. Threaded Connections:

1. A molybdenum disulfide anti-seize compound shall be applied to all threads in mechanical connections such as bolts, studs, cap screws, tubing, etc. unless otherwise indicated.

1.6 SERVICES OF MANUFACTURERS' REPRESENTATIVE

- A. Equipment furnished under Division's 11 and 13 shall include the cost of competent, qualified representatives of manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the operating personnel on operation and maintenance. The training time and additional requirements for furnishing services of manufacturers' representatives are detailed in the appropriate Sections of the Specifications.
- B. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested and is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of the unit shall be submitted within thirty days (30) of completion of the performance test.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01620

SECTION 01630 SUBSTITUTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requests for review of a substitution shall conform to the requirements of the General Conditions and shall contain complete data substantiating compliance of proposed substitution with the Contract Documents.

1.2 CONTRACTOR'S OPTIONS

- A. For materials or equipment (hereinafter products) specified only by reference standard, select product meeting that standard, by any manufacturer, fabricator, supplier or distributor (hereinafter manufacturer). To the maximum extent possible, provide products of the same generic kind from a single source.
- B. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named which complies with the Specifications.
- C. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is permitted, there is no option and no substitution will be allowed.
- D. Where more than one choice is available as a CONTRACTOR'S option, select product which is compatible with other products already selected or specified.

1.3 SUBSTITUTIONS

- A. During a period of 60 days after date of commencement of Contract Time, ENGINEER will consider written requests from CONTRACTOR for substitution of products or manufacturers, and construction methods only in case of unavailability of products or other conditions beyond control of CONTRACTOR.
- B. Submit 5 copies of request for substitution. Submit separate request for each substitution. In addition to requirements set forth in the General Conditions, include in request the following:
 - 1. For products or manufacturers:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature with product description, performance and test data, and reference standards.
 - c. Samples, if appropriate.

- d. Name and address of similar projects on which product was used, and date of installation.
 2. For construction methods (if specified):
 - a. Detailed description of proposed method.
 - b. Drawings illustrating method.
 3. Such other data as the ENGINEER may require to establish that the proposed substitution is equal to the product, manufacturer or method specified.
- C. In making request for substitution, the CONTRACTOR represents that:
1. CONTRACTOR has investigated proposed substitution, and determined that it is equal to or superior in all respects to the product, manufacturer or method specified.
 2. CONTRACTOR will provide the same or better guarantees or warranties for proposed substitution as for product, manufacturer or method specified.
 3. CONTRACTOR waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.
- D. A proposed substitution will not be accepted if:
1. Acceptance will require changes in the design concept or a substantial revision of the Contract Documents.
 2. It will delay completion of the Work, or the work of other contractors.
 3. It is indicated or implied on a Shop Drawing and is not accompanied by a formal request for substitution from CONTRACTOR.
- E. If the ENGINEER determines that a proposed substitute is not equal to that specified, CONTRACTOR shall furnish the product, manufacturer or method specified at no additional cost to OWNER.
- F. Approval of a substitution will not relieve CONTRACTOR from the requirement for submission of Shop Drawings as set forth in the Contract Documents.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01630

SECTION 01710 CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Producing cleaning, during progress of the Work, at completion of the Work, regulatory requirements and schedules.

1.2 REGULATORY REQUIREMENTS

- A. In addition to the requirements herein, maintain the cleanliness of the Work and surrounding premises within the Work limits so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.
- B. Comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish.

1.3 SCHEDULING OF CLEANING AND DISPOSAL OPERATIONS:

- A. So that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.
- B. To prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.
- C. Waste Disposal:
 - 1. Dispose of all non-hazardous waste materials, surplus materials, debris and rubbish in dumpsters. All non-hazardous waste materials shall be disposed of off-site by the CONTRACTOR in accordance with all applicable federal, state and local laws.
 - 2. Do not burn or bury rubbish and waste materials on the plant site.
 - 3. Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 4. Do not discharge wastes into only streams or waterways.

1.4 CLEANING MATERIALS:

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.
- C. Use only materials which will not create hazards to health or property.

1.5 SCHEDULE

A. During Construction:

1. Keep the Work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish.
2. Keep dust generating areas wetted down.
3. Provide suitable containers for storage of non-hazardous waste materials, debris and rubbish until time of disposal.
4. Provide approved 55-gallon drums for storage of hazardous waste materials including but not limited to drill cuttings and personnel protection equipment.
5. Store sealed 55-gallon drums containing hazardous waste materials on-site until an approved TSDF or designated facility will accept the sealed drums in accordance with all RECRA, USEPA, federal, state and local regulations.

B. When Project is Completed:

1. Remove and dispose of all excess or waste materials, debris, rubbish, and temporary facilities from the site, structures and all facilities.
2. Repair pavement, roads, sod, and all other areas affected by construction operations and restore them to original condition or to a minimum condition specified.
3. Remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
4. Repair, patch and touch up chipped, scratched, dented or otherwise marred surfaces to match specified finish.
5. Remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
6. Clean all floors, slabs, pavements and ground surfaces.
7. Maintain cleaning until final acceptance by ENGINEER.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01710

SECTION 01720
RECORD DOCUMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation, maintenance and submittal of Record documentation that reflects the actual work installed and constructed.

1.2 RECORD DOCUMENTS

A. Maintenance of Documents:

1. Maintain in CONTRACTOR'S field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR'S Work.
2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by ENGINEER.
3. Make documents available at all times for inspection by ENGINEER and OWNER.
4. Record documents shall not be used for any other purpose and shall not be removed from the CONTRACTOR'S office without ENGINEER'S approval.

B. Marking System: Provide colored pencils or felt tipped pens for marking changes, revisions, additions and deletions, to the record set of Drawings. Use following color code unless otherwise approved by the ENGINEER:

1. Process and Mechanical: Red
2. Architectural: Blue
3. Structural: Purple
4. Plumbing: Brown
5. HVAC: Green
6. Other Printed Notations: Black

C. Recordings:

1. Label each document "PROJECT RECORDS" in 2-inch high printed letters.
2. Keep record documents current.
3. Do not permanently conceal any Work until required information has been recorded.
4. Drawings: Legibly mark to record actual construction including:

- a. Depths of various elements of foundation in relation to datum.
 - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - d. Field changes of dimensions and details.
 - e. Changes made by Change Order or Field Order.
 - f. Details not on original Drawings.
5. Specifications and Addenda: Legibly mark up each Section to record:
- a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - b. Changes made by Change Order or Field Order.
 - c. Other matters not originally specified.

D. Submittal:

1. Upon Substantial Completion of the Work, deliver one (1) set of record documents to the ENGINEER. Final payment will not be made until satisfactory record documents are received by ENGINEER.
2. Accompany submittal with transmittal letter containing:
 - a. Date.
 - b. Project title and number.
 - c. CONTRACTOR'S name and address.
 - d. Title and number of each record document.
 - e. Certification that each document as submitted is complete and accurate.
 - f. Signature of CONTRACTOR, or his authorized representative.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01720

SECTION 01730
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide operation and maintenance data in the form of instructional manuals for use by the operation personnel for all equipment, systems, valves, related accessories, all instruments and control devices.

1.2 DEFINITIONS:

- A. The term "operation and maintenance data" includes all product related information and documents which are required for preparation of the plant operation and maintenance manual.
- B. Required operation and maintenance data include, but are not limited to, the following:
 - 1) Complete, detailed written operating instructions for each product or piece of equipment including: equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal and emergency conditions; regulation and control; and shutdown.
 - 2) Complete, detailed written preventive maintenance instructions as defined below.
 - 3) Recommended spare parts lists and local sources of supply for parts.
 - 4) Written explanations of all safety considerations relating to operation and maintenance procedures.
 - 5) Name, address and phone number of manufacturer, manufacturer's local service representative, and Subcontractor or installer.
 - 6) Copy of all approved Shop Drawings, and copy of warranty bond and service contract as applicable.
- C. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted and maintained so that the item functions economically throughout its full design life.

- D. Preventive maintenance instructions include, but are not limited to, the following:
- 1) A written explanation with illustrations for each preventive maintenance task.
 - 2) Recommended schedule for execution of preventive maintenance tasks.
 - 3) Lubrication charts.
 - 4) Table of alternative lubricants.
 - 5) Trouble shooting instructions.
 - 6) List of required maintenance tools and equipment.

1.3 SUBMITTALS:

- A. Submit operations and maintenance data to the ENGINEER within 90 days after approval of Shop Drawings unless noted otherwise.
- B. Number of Copies: Six (6) of each item.
- C. Letter of Transmittal: Provide a letter of transmittal with each submittal and include the following in the letter:
1. Date of submittal.
 2. CONTRACTOR'S name and address.
 3. A list of the attachments and the Specification Sections to which they relate.
 4. Reference to or explanation of related submittals already made or to be made at a future date.
- D. Format Requirements:
1. Use 8-1/2 inch by 11 inch paper of high rag content and equality. Larger drawings of illustrations are acceptable if neatly folded to the specified size in a manner which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab. Or provide fly-leaf for each product.
 2. All text must be legible typewritten or machine printed originals of high quality copies of same.
 3. Each page shall have a binding margin of approximately 1-1/2 inches and be punched for placement in a three ring looseleaf or triple post binder. Provide binders. Identify each binder with the following:
 - a. Title "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - b. Title of Project/Project No.
 - c. Contract No.
 - d. Identity of general subject matter covered.
 4. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

5. Provide a table of contents for each binder.
6. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01730

SECTION 01750
SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedures to furnish spare parts and maintenance materials as specified in the individual Sections.

1.2 SPARE PARTS

- A. Parts and materials shall be furnished in manufacturer's unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified.
- B. During construction, store parts in accordance with manufacturers' recommendations. Protect from weather, condensation and humidity.
- C. Parts and materials shall be delivered to the OWNER upon completion of the Work. CONTRACTOR shall then place them in permanent storage rooms or areas approved by the ENGINEER.
- D. CONTRACTOR shall be fully responsible for loss or damage to parts and materials until they are transmitted to the OWNER.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01750

SECTION 02060
DEMOLITION AND REMOVALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Demolition, removal and disposal of existing floor slab, mechanical equipment, transformers, switchgear, panelboards, switches, circuit breakers, electrical conduits, motors, limit switches, pressure switches and instrumentation as designated to be removed on the Drawings. All electrical equipment to be retained shall be relocated or isolated by the CONTRACTOR prior to the removal of the equipment specified herein and shown.

1.2 RELATED SECTIONS:

- A. Section 02220, Excavation and Backfill.

1.3 SUBMITTALS

- A. Submit for approval a detailed description of methods, equipment and sequence of the demolition for the ENGINEER's review and comments.

1.4 PROTECTION

A. General:

1. Demolition and removal Work shall be performed by competent workmen experienced in the various types of demolition and removal work required and shall be carried through to completion with due regard to the safety of all OWNERS employees, workmen on the Site and the public. The Work shall be performed with as little nuisance as possible.
2. The Work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes and as hereinafter specified.
3. Perform investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with the demolition.
4. Provide interior and exterior shoring, bracing and support to prevent movement, settlement, or collapse of existing structures or facilities. The OWNER assumes no responsibility for the actual condition of the structures or facilities adjacent to the Work or the structures or facilities designated for removal or modification.

5. Do not bring explosives on site. No explosives will be permitted for this Project.

B. Execution:

1. Provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.
2. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.
3. Provide and maintain temporary protection of the existing structure designated to remain where the demolition, Work and new Work is being performed, connections are being made, materials are handled or equipment moved.
4. Take all necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dustproof partitions and other adequate means.
5. Provide adequate fire protection in accordance with the local Fire Department requirements.
6. Do not close or obstruct walkways, passageways, or stairways and do not store or place materials in passageways, stairs or other means of egress. CONTRACTOR shall conduct operations with minimum traffic interference.
7. CONTRACTOR shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.
8. Carry out all operations so as to avoid interference with operations and work in the existing facilities and the work under other contracts.
9. Be solely responsible for making all necessary arrangements and for performing all necessary work involving the discontinuance or interruption of all utilities or services.
10. Any equipment, piping and appurtenances removed without proper authorization, shall immediately be replaced to the satisfaction of ENGINEER at no cost to OWNER.

C. Notification:

1. At least 48 hours prior to commencement of all demolition or removal Work, the CONTRACTOR shall notify the ENGINEER in writing of this proposed schedule. OWNER shall inspect the existing equipment and review with CONTRACTOR those items which are to remain the property of OWNER. No removals shall be started without the permission of ENGINEER.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. The Work required shall be done with care, and shall include all required shoring, bracing, etc. The CONTRACTOR shall be responsible for any damage which may be caused by the demolition and removal Work to any part or parts of the existing structures or items designated for reuse or to remain. The CONTRACTOR shall perform patching, restoration and new Work in accordance with applicable technical sections of the Specification and in accordance with the details shown on the Drawings.
- B. There is no guarantee by the OWNER that the number of fixtures, amount of equipment or any other material of value existing in the buildings and structures to be demolished at the bidding time will be present in the structures when they are demolished. The CONTRACTOR shall have no claim against the OWNER because of the absence of such fixtures and materials.
- C. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces, which have holes, scars, chipped or other damaged surfaces revealed by the removal shall be repaired by CONTRACTOR with the same or matching materials as the existing surface or as may be otherwise approved by ENGINEER.
- D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - 2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.
- E. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately one inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable sections of the Specifications, as shown, or as directed by ENGINEER. Wall sleeves and

castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate sections of the Specifications, as shown or as directed and approved by ENGINEER.

- F. Where equipment is shown or specified to be removed and relocated, the CONTRACTOR shall not proceed with removal of this equipment without specific prior approval of the ENGINEER. Such items shall be removed with care, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during removal shall be replaced with similar new material or items. Any equipment that is removed without proper authorization and is required for plant operation shall be replaced at no cost to the OWNER.
- G. Wherever piping is to be removed for disposition, the piping shall be drained by CONTRACTOR and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.
- H. Where alterations occur, or new and old Work join, the CONTRACTOR shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered Work in as good a condition as existed prior to the start of the Work. The materials and workmanship employed in the alternations, unless otherwise shown on the Drawings or specified, shall comply with that of the various respective trades which normally perform the particular items of work.
- I. Confine the cutting of the existing Building Floor to the limits of the new Work.
- J. Remove all temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the Work.

3.2 STRUCTURAL REMOVALS

- A. Remove concrete and structures to the lines and grades shown unless otherwise directed by ENGINEER. Where no limits are shown, the limits shall be 4 inches outside the item to be installed. The removal of masonry beyond these limits shall be at CONTRACTOR's expense and these excess removals shall be reconstructed to the satisfaction of ENGINEER with no additional compensation to the CONTRACTOR.
- B. Determine the thickness of existing concrete to be removed and the extent to which it is reinforced. No additional compensation will be made because of variations from the thickness shown or for variations in the amount of reinforcement.

- C. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the ENGINEER. Demolished items shall not be used in backfill.
- D. After removal of parts or all of masonry walls, slabs and like work which tie into new Work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and finished surfaces exposed.

3.3 PAVEMENT, CURB AND SIDEWALK REMOVALS

- A. Remove existing pavement, including base and surface courses, stabilized sub-bases, curbs, and gutters as required to construct new facilities or as shown. Before removing, saw a straight joint at least 1-1/2-inches deep between sidewalk and pavement designated for removal and that left in place. Curbs and gutters shall be removed to the nearest construction joint beyond the end of demolition symbol shown on the Drawings.
- B. Provide for satisfactory transition between replaced pavement and sidewalks and the portions remaining in place.

3.4 EQUIPMENT REMOVALS

- A. Equipment removals shall consist of dismantling and removing of existing piping, pumps, motors, equipment, and other appurtenances as specified, shown, or required for the completion of the Work. It shall include cutting, capping, draining, and plugging as required. The cutting of existing piping for the purpose of making connections will be included under Division 15.
- B. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new Work or is shown or specified to be removed.
- C. Water and vent piping shall be removed to points shown or required. Pipe shall be plugged with cleanouts and plugs. Where piping or ducts pass through existing roof the hole in the roof shall be properly patched and made the watertight.
- D. Any demolition or changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes. Portions of the potable water system that may have been altered or opened shall be pressure tested and disinfected in accordance with Division 15 and local codes. Other plumbing piping and heating piping shall be pressure tested only.

- E. Provide all caps, plugs, blind flanges, shut-off valves and other work and materials required to remove from service existing piping and necessary to keep existing piping in service where shown or required.

3.5 ELECTRICAL REMOVALS

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, panelboards, lighting fixtures, and miscellaneous electrical equipment all as required to perform the Work.
- B. All existing electrical equipment and fixtures to be removed shall be removed by the CONTRACTOR with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.
 - 1. The Electrical CONTRACTOR shall, in conjunction with OWNER, de-energize panelboards, lighting switches, pressure switches, instrumentation, wiring and similar power equipment prior to removal.
- C. Where shown or otherwise required, wiring shall be removed. The CONTRACTOR shall verify the function of all wiring before disconnecting and removing it. Ducts which are not to be reused shall be plugged and made watertight. All openings in buildings for entrance of abandoned conduit or direct-burial cable shall be patched and made watertight.
- D. Panelboards shall be removed and disposed of off the site. All cutting and patching necessary for the removal and replacement of panelboards shall be performed.
- E. Lighting fixtures shall be relocated as shown or required to install the new Work or perform the demolition work.
- F. Switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed of off the site. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. Any damage incurred shall be repaired.

3.6 MISCELLANEOUS REMOVALS

- A. CONTRACTOR shall remove miscellaneous concrete walls, slabs, pipe supports, equipment pads, and curbs where shown on the Drawings or where necessary for the construction of new structures or modification of existing structures. Anchor bolts shall be cut back one inch below the concrete surface and the hole patched.

3.7 MODIFICATIONS AND CLOSURES

- A. Modifications shall conform with all applicable Specifications, the Drawings, and the directions and approvals of ENGINEER.
- B. Where alterations require cutting or drilling into existing floors, walls, and roofs the holes shall be repaired in an approved manner. Repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by ENGINEER. All repairs shall be smoothly finished unless otherwise approved by ENGINEER.
 - 1. CONTRACTOR shall confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new Work. CONTRACTOR shall cut and remove insulation, etc. and provide temporary weathertight protection as required until new roofing, insulation and flashings are installed.
- C. Openings in existing concrete slabs, ceilings, roofs, masonry walls, floors and partitions which are not to be used in the new Work shall be closed and sealed as shown or otherwise directed by ENGINEER.
- D. Where parts of exiting structures are to remain in service, demolish the portions to be removed, repair damage, and leave the structure in proper condition for the intended use. Remove concrete and masonry to the lines designated by drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp straight corners that will result in neat joints with new construction or be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean undamaged. Cut off other reinforcing flush with the surface.
- E. All new Work shall be keyed into the existing in an acceptable manner. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, the same or matching materials as the existing adjacent surface shall be used. The finished closure shall be a smooth, tight, sealed, permanent closure with all exposed surfaces smooth finished and acceptable to ENGINEER.

3.8 TITLE TO EQUIPMENT AND MATERIALS

- A. CONTRACTOR shall have no right or title to any of the equipment, materials or other items removed from the existing buildings or structures unless otherwise directed by the ENGINEER. The CONTRACTOR shall not sell or assign or attempt to sell or assign any interest in the said equipment, materials or other items until the said equipment, materials or other items have been removed.

- B. CONTRACTOR shall have no claim against OWNER because of the absence of such fixtures and materials.

3.9 CONDITION OF BUILDINGS, STRUCTURES AND EQUIPMENT

- A. The OWNER does not assume responsibility for the actual condition of buildings, structures and equipment to be demolished and removed.
- B. Conditions existing at the time of inspection for bidding purposes will be maintained by OWNER so far as practicable.
- C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the ENGINEER nor OWNER will be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR.

3.10 MAINTENANCE AND CLEAN UP

- A. Maintain the buildings, structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.
- B. Provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.
- C. At reasonable intervals during the progress of the demolition and removal Work (or as directed by the ENGINEER) clean the Site and properties, and dispose of waste materials, debris and rubbish.

END OF SECTION 02060

SECTION 02220
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavating, backfilling and disposing of earth materials for the purpose of constructing structures, conduits, pipelines and other facilities. Preparation of subgrade for footings, foundations, and slabs and temporary means needed to prevent discharge of sediment to water courses.

1.2 QUALITY ASSURANCE

- A. Source Quality Control: CONTRACTOR shall be responsible for the payment of all testing required to determine the acceptability of proposed fill and backfill material.
- B. Permits and Regulations:
 - 1. All required building and construction permits.
 - 2. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
 - 1. ASTM A 36, Structural Steel.
 - 2. ASTM A 328, Steel Sheet Piling.
 - 3. ASTM D 422, Particle-Size Analysis of Soils.
 - 4. ASTM D 423, Liquid Limit of Soils.
 - 5. ASTM D 424, Plastic Limit and Plasticity Index of Soils.
 - 6. ASTM D 1556, Density of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D 2487, Classification of Soils for Engineering Purposes.
 - 8. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

1.3 SUBMITTALS

- A. Submit for review and comment the following items:
 - 1. Sheeting and bracing.
 - 2. Protection methods anticipated.
 - 3. Underpinning.

- B. The Drawings shall be prepared by a professional engineer registered in the State of Rhode Island and recognized as expert in the specialty involved. The Drawings shall be submitted to the ENGINEER for purposes of establishing that the terms of the Specifications are complied with only. Submit calculations and all other pertinent information. Drawing submissions will not be checked and will not imply approval by the CONTRACTOR of the work involved.
- C. CONTRACTOR shall be wholly responsible for designing, installing and operating whatever system is necessary to accomplish satisfactory sheeting, bracing, protection, underpinning and dewatering.

1.4 JOB CONDITIONS

- A. Perform two (2) test borings in the area of the Equalization Tanks Containment Area to verify the soil bearing capacity.
- B. Existing Structures and Utilities:
 - 1. Shown on the Drawings are certain surface and underground structures adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the CONTRACTOR. Explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from injury by the CONTRACTOR. If they are broken or otherwise damaged, they shall be restored immediately by the CONTRACTOR at his expense.
 - 2. Locate existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - a. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the OWNER and ENGINEER immediately for directions as to procedures to be taken. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - 3. Do not interrupt existing utilities serving facilities occupied and used by others, except when permitted in writing by OWNER and then only after acceptable temporary utility services have been provided.
- C. Use of Explosives: Not permitted on the job site.
- D. Protection of Persons and Property:
 - 1. Barricade open excavations occurring as part of this Work and post with warning lights.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- E. Dust Control: Conduct all operations and maintain the area of activities, including sweeping and sprinkling of roadways, so as to minimize creation and dispersion of dust.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Select Fill and Backfill Materials:
1. Place below footings, foundations, slabs and against structure walls.
 2. Fill shall be well-graded, granular material or bank run gravel, free from organic matter. All fill shall be from a clean, virgin source, and not subject to previous industrial activity. Not more than 50 percent by weight shall pass through a No. 40 sieve; not more than 10 percent by weight shall pass through a No. 200 sieve; and 100 percent shall pass a 6-inch square sieve.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which excavating are to be performed and notify the ENGINEER of conditions he may find that are detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 TEST PITS

- A. Where ordered by the ENGINEER, excavate and backfill, in advance of construction, test pits to determine conditions or location of existing facilities.
- B. Test pits may be made by the CONTRACTOR for his own use at no additional cost to the OWNER.

3.3 EXCAVATION

A. General:

1. Perform all excavation required to complete the Work as shown and specified.
2. Excavated Materials: Earth, sand, clay, gravel, hardpan, boulders not requiring drilling or jackhammering to remove, decomposed rock, sediment, rubbish and all other materials within the excavation limits, except rock.

B. Structures and Pipelines:

1. Excavations: Open excavations, shored and braced where necessary to prevent possible injury to workmen and to new and existing structures or pipelines.
2. Sheet piling and Bracing: Install in accordance with drawings submitted under Article 1.3 above.

C. Footings:

1. Consider the elevation of the bottom of footings shown as approximate only and the ENGINEER may order such changes in dimensions and elevations as may be required to secure a satisfactory footing.
2. Hand trim all structure excavations to permit the placing of full widths, and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.
3. When excavations are made below the required grades, without the written order of the ENGINEER, backfill with well graded granular material to be compacted to the specified density or concrete as directed by the ENGINEER at expense of CONTRACTOR.

D. Size of Excavations: Extend excavation sufficiently on each side of structures, footings, etc., to permit setting of forms, installation of sheet piling or the safe sloping of banks.

E. Subgrades:

1. General Requirements: The compaction of backfill shall be maintained at +2 percent from optimum moisture content. The compacted fill shall remain firm and in tact under all construction operations. Mud, muck and other soft or unsuitable materials shall be removed.
2. Subgrade Requirements for Pipeline Trench Bottoms and Floor Slabs: Compact to at least 90% of the maximum modified Proctor Method dry unit weight.
3. Subgrade Requirements for Footing Foundations: Compact to at least 95 percent of the maximum modified Proctor dry unit weight.
4. Soft Subgrades: For subgrades which are otherwise solid, but which become soft or mucky on top due to construction operations, follow these procedures:
 - a. Remove the soft and mucky material and replace with suitable backfill

and recompact to the specified density. The soft surface can also be stabilized with crushed stone, crushed slag or lime.

- b. Overlay with geotextile fabric prior to placement of crushed stone or gravel.
- 5. Finished Elevation of Stabilized Subgrades: Do not place above subgrade elevations shown.

F. Stability of Excavations:

- 1. Sides of Excavations: Slope to comply with codes and ordinances of agencies having jurisdiction.
- 2. Shoring and Bracing: Where sloping is not possible either because of space restrictions or stability of material excavated.
- 3. Safety: Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- 4. Caving: If caving occurs outside the excavation area, backfill the resulting hole in accordance with the requirements of this section after removing the loose material.

G. Material Storage:

- 1. Stockpile excavated materials in an approved area, until required for backfill or fill. Do not place clean soil in the protection area.
- 2. Place, grade and shape stockpiles for proper drainage.
- 3. Locate and retain soil materials away from edge of excavations.
- 4. Excess soil and waste materials shall be stored on-site and tested to determine heavy metal concentrations.

H. Unsuitable Material:

- 1. Where the existing material beneath the bedding material is considered unsuitable by the ENGINEER, remove and replace it with select backfill.
- 2. The selected backfill shall be compacted in accordance with the specified density criteria in subsection 3.7.

3.4 UNAUTHORIZED EXCAVATION

- A. All excavation outside the lines and grades shown.
- B. All unauthorized excavation together with the removal, testing, required treatment and disposal of the associated materials is at the CONTRACTOR'S expense.
- C. Fill and compact the unauthorized excavation with select backfill and at CONTRACTOR'S expense.

3.5 DRAINAGE AND DEWATERING

A. General:

1. Prevent surface and subsurface water from ponding in the excavations and from flooding adjacent areas.
2. Remove water from excavation as fast as it collects.
3. Maintain the ground water level at least 3 feet below the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for the permanent work, and to prevent damage to the Work during all stages of construction.
4. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.
5. Obtain ENGINEER's approval before shutting down dewatering system for any reason.

B. Standby Requirements for Dewatering: Provide standby equipment to ensure continuity of dewatering operations.

C. Disposal of Water Removed by Dewatering System:

1. Dispose of all water removed from the excavation to a storage tank prior to discharge to the local sanitary sewer.
2. Dispose of water in such a manner as to cause no inconvenience to the OWNER, ENGINEER, or others involved in work about the site.
3. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches.

3.6 SHEETING, SHORING AND BRACING

A. General:

1. Sheet, shore and brace all open excavations where necessary to prevent injury to workmen, structures, or pipe lines.
2. Observe all municipal, county, state and federal ordinances, codes, regulations and laws.
3. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.
4. Timber Used for Breast Boards (lagging): New or used, meeting the requirements for Douglas Fir Dense Construction grade or Southern Pine No. 2 Dense S3.
5. Design in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings(m), of the AISC all

steel work for sheeting, shoring, bracing, cofferdams, etc. except that field welding will be permitted.

6. Steel Sheet Piling: Manufactured from steel conforming to ASTM A 328. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36. Furnish mill test reports on new piling but not used ones.
7. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
8. Unless otherwise shown, specified, or ordered, remove all materials used for temporary construction when work is completed. Make this removal in a manner not injurious to the structure or its appearance or to adjacent Work.
9. **Safe and satisfactory sheeting shall be the entire responsibility of the CONTRACTOR.**

B. Removal of Sheeting and Bracing:

1. Remove sheeting and bracing from excavation unless otherwise directed in writing by the ENGINEER.
2. Conduct removal so as to not cause injury to the Work.
3. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure.
4. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete until the following conditions are satisfied:
 - a. Concrete has cured a minimum of 7 days.
 - b. Wall and floor framing up to and including grade level floors are in place.

3.7 GENERAL BACKFILL

- A. Furnish, place and compact all general backfill and fill required to provide the finished grades shown and described herein.
- B. Restrictions: Backfill excavations as promptly as Work permits, but not until completion of the following:
 1. Reviewed by ENGINEER of construction below finish grade.
 2. Inspection, testing, approval, and recording of locations of underground utilities.
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 5. Removal of trash and debris.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
 7. Placement of settlement plates.
- C. Placement:
1. Keep excavation dry during backfilling operations.
 2. Bring up backfill evenly on all sides around structures.
 3. Compact fill to the degree and within the moisture content specified in Paragraph 3.7.I of this Section.
- D. Backfill Against Concrete:
1. Do not differ the levels of backfill against concrete walls by more than 2 feet on either side of walls unless walls are adequately braced.
- E. Thickness of Lifts: Unless otherwise specified or required, place fill in horizontal loose lifts not exceeding 9 inches in thickness and mix and spread in a manner assuring uniform lift thickness after placing.
- F. Moisture:
1. Control the water content of fill material during placement within the range necessary to obtain the compaction specified.
 2. In general, maintain the moisture content of the fill within 2 percent of the optimum moisture content for compaction as determined by laboratory tests.
 3. Perform all necessary work to adjust the water content of the material to within the range necessary to permit the compaction specified.
 4. Do not place fill material when free water is standing on the surface of the area where the fill is to be placed.
 5. No compaction of fill will be permitted with free water on any portion of the fill to be compacted.
- G. Unacceptable Material:
1. Do not place or compact fill in a frozen condition or on top of frozen material.
 2. Remove fill containing organic materials or other unacceptable material and replace with approved fill material.
- H. Equipment:
1. Compact fill with equipment suitable for the type of material placed and which is capable of providing the densities required.
 2. Select compaction equipment and submit it and proposed procedure to the ENGINEER for approval.

I. Compaction Criteria:

1. General backfill shall be compacted to at least 90 percent of the maximum modified Proctor dry unit weight as achieved by ASTM D 1557.
2. The backfill shall be compacted with a moisture content within +2 percent of the optimum moisture content.

J. Tests:

1. Test the effectiveness of the equipment at the commencement of compacted fill Work by construction of a small section of fill within the area where fill is to be placed.
2. If tests on this section of fill show that the specified compaction is not obtained, increase the amount of coverages, decrease the lift thickness or obtain a different type of compactor.
3. No additional cost to the OWNER shall be incurred.

K. Backfill Around Structures:

1. Follow the specified procedures for backfill around structures except that within 2 feet of foundations and underground structures, use light compaction equipment with the gross weight of the equipment not exceeding 7,000 pounds.
2. Provide equipment that is capable of the required compaction within restricted areas next to structures and around piping.

L. Inadequate Compaction:

1. If the specified densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment, perform whatever work is required to provide the required densities.
2. This work includes complete removal of unacceptable fill areas and replacement and recompaction until acceptable fill is provided.

M. Settlement:

1. Repair any settlement that occurs, at CONTRACTOR'S expense.
2. Make all repairs and replacements necessary within 30 days after notice from the ENGINEER or OWNER.

3.8 SELECT BACKFILL

- A. Furnish, place and compact all select backfill and fill required as shown and described herein.

B. Restrictions:

1. Make subgrade surface level, dry, firm and subject to CONTRACTOR'S approval.
2. Do not place fill if any water is on the surface of area to receive fill.
3. Do not place or compact fill in a frozen condition or on top of frozen material.

C. Thickness of Lifts:

1. Place fill in horizontal loose lifts of 9 inches maximum thickness.
2. Mix and spread in a manner to assure uniform lift thickness after placing.
3. Compact each layer of fill before placement of the next lift.

D. Unacceptable Material:

1. Do not place fill containing lumps or pockets of soil. Fill material containing rubble, debris, wood or other organic matter is not acceptable.
2. Remove and dispose of fill containing unacceptable material.

E. Moisture:

1. The water content of the fill being compacted shall be within the range of plus or minus 2 percentage points from the optimum moisture content of the material.
2. Wet the fill materials during placement to achieve water contents needed for effective compaction.

F. Equipment:

1. Perform compaction of fill with equipment suitable for the type of fill material being placed.
2. Select equipment which is capable of providing the densities required and submit the equipment to the ENGINEER for review.
3. Vibratory rollers or vibratory plate compactors are suitable for compaction of select fill.

G. Coverage:

1. Compact each layer of fill material by at least two complete coverages of all portions of the surface of each lift using suitable compaction equipment.
2. One coverage is defined as the condition reached when all portions of the fill lift have been subjected to the direct contact of the compacting surface of the compactor.

H. Compaction:

1. The minimum density to be obtained in compacting the selected backfill or fill below the footing foundation shall be 95 percent of the maximum modified Proctor dry unit weight obtained in the laboratory in accordance with ASTM

D 1557, Method C.

2. If the field and laboratory tests indicate unsatisfactory compaction, provide the additional compaction necessary to obtain the specified degree of compaction.

I. Disturbed Materials:

1. Provide, place and compact select fill necessary to replace subgrade materials disturbed and softened as a result of the CONTRACTOR'S operations or to backfill unauthorized excavation.
2. Furnish additional fill at the CONTRACTOR'S expense.

3.9 GRADING

A. General:

1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
2. Smooth subgrade surfaces within specified tolerances.
3. Compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

3.10 DISPOSAL OF EXCAVATED MATERIALS

- A. Following testing, all excess material removed from the excavations will be disposed of off the site in accordance with EPA, state and local regulations.

END OF SECTION 02220

SECTION 02545 PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install temporary and permanent hot-mix bituminous paving.

1.2 PAVEMENT

- A. The Work includes permanent and temporary pavements comprised of one or more of the following:
 - a. Aggregate base course.
 - b. Tack coats.
 - c. Binder course.
 - d. Top course.
 - e. Pavement marking.
- B. Temporary pavement shall be placed as necessary to maintain continuous access to the parking lot and other locations on-site.
- C. In order to prevent damage to the permanent pavement by CONTRACTOR's operations, all permanent pavement materials, including the aggregate base course, shall not be installed until approved in writing by ENGINEER. The finished course of paving shall not be installed until all structures, equipment, piping and outside facilities are substantially completed and at a time approved by ENGINEER.

1.3 RELATED SECTIONS

- A. Section 02060, Demolition and Removals.
- B. Section 02220, Excavation and Backfill.

1.4 QUALITY ASSURANCE

- A. Laboratory approval of the sources of supply of the fine aggregates, coarse aggregates, mineral filler, bituminous materials, liquefiers and any other materials used in the mix shall be obtained and submitted by CONTRACTOR. No delivery or mixed materials shall be made from any bituminous mixing plant until the source of supply are approved.

1.5 SUBMITTALS

- A. Submit for approval job mix formula proposed, giving complete data on materials, including source, location, percentages, temperatures, date of last testing, and all other pertinent data.

1.6 JOB CONDITIONS

- A. Weather Limitations:
 - 1. Permanent paving materials, including the aggregate base course, shall be placed only when the air temperature is 40 degrees Fahrenheit and rising or warmer and the surface on which the paving is to be laid is 40 degrees Fahrenheit or higher. All temperatures are to be measured in the shade.
 - 2. Bituminous pavement for temporary uses, that are not and will not become part of a permanent pavement, will not be subject to the above regulations in regard to weather limitations. No pavement, however, shall be laid on a frozen subgrade.
- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope for each course during construction operations.

PART 2 PRODUCTS

2.1 PAVEMENT THICKNESS

- A. In-place compacted material thickness shall not be less than 6 inches.

2.2 MATERIALS

- A. Materials shall conform to the following:
 - 1. Subgrade shall be virgin material or select fill conforming to the requirements of Section 02220, Excavation and Backfill.
 - 2. Base Courses:
 - a. Aggregate for permanent pavement base course shall consist of crushed stone conforming to the following gradation:

<u>Screen Size</u>	<u>% Passing</u>
1-1/2-in	100
1-in	100
1/2-in	65-85
3/8-in	55-75
#4	40-55

#8	30-45
#16	22-36
#30	16-27
#50	12-19
#100	7-13
#200	3-8

3. Pavement:
 - a. Permanent: Provide a two course wearing surface for permanent pavement, consisting of a binder course and a top course.
 - b. Temporary: Provide a one course wearing surface for temporary pavement, consisting of a top course as specified above.
4. Tack Coat: Tack coat shall be an asphalt emulsion.

PART 3 EXECUTION

3.1 GENERAL

- A. Installation of all pavement materials and pavement markings shall be performed by experienced personnel.
- B. Preparing the mixtures, paving equipment, placing the mixes, and compacting the mixes shall be in accordance with below.
 1. Preparing the mixtures includes the plant equipment, stockpiling, heating, aggregate processing, mixing of aggregate and bituminous material, and transportation to job site.
 2. Paving equipment includes bituminous pavers, rolling equipment and hand tools.
 3. Placing the mixes includes paver placing, hand placing, spreading, tamping and jointing.
 4. Compacting the mixes includes breakdown rolling, second rolling and finish rolling.
- C. Regardless of the type of temporary or permanent restoration involved, CONTRACTOR shall insure that all castings are set flush with the road surface. CONTRACTOR is advised that there shall be no placement of bituminous concrete top course until:
 1. Manholes have been constructed to their final elevation.
 2. Defective areas of the binder course have been repaired.
- D. Provide final surfaces of uniform texture, conforming to required grades and cross sections.

3.2 SUBGRADE PREPARATION

- A. Permanent Pavement: Preparation of the permanent pavement subgrade including compaction shall be completed for the full width of the surface.
 - 1. Fine grade earth subgrade and compact with self-powered rollers of sufficient size to provide a firm, unyielding surface to receive the aggregate base course. Remove and replace all unsuitable subgrade material as directed by ENGINEER.
 - 2. Where the subgrade is constructed by excavation of the existing grade, the top 6-inches of the subgrade shall be compacted to at least 95 percent of maximum density at optimum moisture content as determined in ASTM D 698.
 - 3. When the subgrade is constructed on fill:
 - a. Existing grade shall be made smooth and compacted per Section 3.2.A.2.
 - b. Subgrade shall be brought to the appropriate lines and grades utilizing select backfill placed in accordance with the applicable requirements of Section 2D1, Excavation and Backfill.
 - 4. Existing grades prior to placement of subbase or backfill shall be established such that when materials for construction are placed no rutting or displacement will occur.
- B. Temporary Pavement: Subgrade shall be compacted with a ten (10) ton roller or other approved method.
- C. No materials, temporary or permanent, shall be placed on subgrades which are muddy or have water thereon.

3.3 PERMANENT PAVEMENT BASE COURSE INSTALLATION

- A. Construct base course to thickness specified in equal layers not more than three inches (compacted) thick. If subgrade material is worked into the base material during compaction or finishing operations, remove the aggregate over this area and replace with new aggregate.
- B. Compact each layer with a power driven roller weighing not less than ten tons in an approved manner with the aid of water. Before mixing and spreading the base material, the moisture content shall be both sufficient to prevent segregation into pockets of fine and coarse material, and to permit satisfactory compaction. Add water as required.
- C. After compaction, the top surface of this course shall not extend above, nor more than 1/2-inch below true grade and surface at any location. Depressions shall be filled with additional aggregate material and the surface rerolled. Base course shall

be maintained by CONTRACTOR within the 1/2-inch tolerance until the pavement course is installed.

3.4 PAVEMENT INSTALLATION

- A. Contact surfaces of all curbs, gutters, castings and adjacent pavement edges shall be painted with a layer of tack coat before placing or repairing the pavement course.
- B. Bituminous concrete shall be constructed to thicknesses specified and rolled with a twelve (12) ton self powered two axle or three axle tandem or three wheel roller to a density of 94 percent of maximum.
- C. Pavement shall be uniform in appearance, free of bumps and hollows, worked to drain, and free of bleeding.
- D. Trim the existing pavement with pneumatic chisels of all loose edges and broom and tack coat all edges prior to placing the transition pavement.
- E. In placing and compacting abutting courses of bituminous concrete pavements, joint heating devices shall be used on all joints (transverse, longitudinal and existing).
- F. Bituminous pavement shall match in thickness the existing pavement and shall butt with the pavement in a smooth, even transition.
- G. Test bituminous pavement for conformity with the specified crown and grade immediately after initial compression. Correct variations by the removal or additional of materials and by continuous rolling.
- H. The finished surface shall not vary more than 1/4-inch when tested with a 16-ft straightedge applied parallel with, or at right angles to, the centerline.
- I. After final rolling, again test the smoothness of the course. Correct humps or depressions exceeding the specified tolerances or that retain water on the surface by removing the defective work and replacing with new material.

3.6 TEMPORARY PAVEMENT OVER TRENCHES

- A. Bituminous concrete plant mix to be utilized for temporary pavement over trenches, as required, shall conform to the requirements for the top course Type La plant mix.

- B. Trenches for utility work within existing paved areas shall receive temporary pavement. The ENGINEER shall determine the limits of temporary pavement to be installed over these trenches.
- C. After the trench has been properly backfilled, excavation shall be made over the trench area and the sub-grade compacted by rolling with a ten ton roller or other approved methods, so as to permit the placing of a one and one-half inch (1-1/2") compacted thickness of bituminous concrete. The sub-grade shall not be in a muddy or frozen condition and shall be smooth and parallel to the desired surface of the finished pavement. Compaction of this 1-1/2" minimum thickness bituminous concrete shall be as specified herein.

3.7 PATCHING

- A. Remove and replace all defective areas in temporary and permanent pavements. Cut-out such areas and fill with fresh Type La bituminous concrete top course as specified. Compact to the required density.

3.8 CLEANING AND PROTECTION

- A. After completion of paving operations, clean surfaces of excess or spilled bituminous materials and all foreign matter.
- B. Protect newly finished pavement until it has become properly hardened by cooling.
- C. During the paving operation cover openings of drainage structures in the area of paving.

3.9 MAINTENANCE AND ACCEPTANCE

- A. Maintain all paved surfaces until the roads and parking areas have been accepted. Paved areas will not be accepted until after CONTRACTOR has completed all phases of the work, including all necessary transportation, hauling and severe usage of the paved areas. ENGINEER shall be the sole judge in this matter.

END OF SECTION 02545

SECTION 02671
SOIL VAPOR EXTRACTION WELL MODIFICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modifying wells VE-1R, VE-2R, VE-3R, VE-9, VE-10, and VE-11 for soil vapor and groundwater extraction.

1.2 RELATED SECTIONS

- A. Section 11210 - SVE System Groundwater Pumps
- B. Section 11340 - SVE Equipment
- C. Section 15060 - SVE Piping and Appurtenances
- D. Section 15260 - Piping Insulation
- E. Section 15980 - Functional Description and Instrumentation and Controls

1.3 REFERENCES

- A. Refer to 1.2 Related Sections.

1.4 SYSTEM DESCRIPTION

- A. General: Six wells (VE-1R, VE-2R, VE-3, VE-9, VE-10, and VE-11 (formerly MW-14S) will be modified. The wells are screened through the unsaturated zone into the saturated zone and the modifications to these wells will enable them to extract both contaminated groundwater and soil gas. None Aqueous Phase Liquid (NAPL) is not anticipated to be encountered.
- B. Vapor Extraction: The wells will be fitted with a TEE WYE reducing fitting, as specified by the Contract Drawings, to facilitate the connection of a 4 inch vapor extraction pipe directly onto the well riser (casing) as well as provide access for installation and adjustment of level sensing equipment and the water extraction straw. The vapor extraction wells will be used to extract soil gases by applying vacuum, generated in an air vacuum tank, directly to the unsaturated zone soils. Each well riser will be provided with a vacuum gauge for measurement of the vacuum level applied to the well.

- C. Groundwater Extraction: In addition, each well will also be provided with a water extraction straw, set at the desired depth within the well, as specified by the Contract Drawings, and run coaxially through the vapor extraction pipe, from the well to the water extraction manifold. A vacuum applied to the manifold, generated by the water extraction tank and water discharge pump system will facilitate groundwater extraction from the wells through the water extraction straw. Intrinsically-safe water level sensors will be installed into each well to provide a control signal to the corresponding water extraction manifold solenoid valve in order to control each well's water extraction rate and pumping level.

1.5 SUBMITTALS FOR REVIEW

- A. Section 1E4 - Shop Drawing Submittal and Correspondence Procedure
- B. Product Data: Include data indicating rated capacities, working pressure, materials of construction, and accessories.

1.6 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Assembly, and installation instructions.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section - 1I2 - Record Documents

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with references identified in sections listed in 1.2 Related Sections.
- B. Submit proof of state well drillers/pump installers license to perform this work.

1.9 SEQUENCING

- A. Sequence Work to occur before placement of water and vapor extraction piping interconnecting the extraction wells with the VES trailer.

PART 1 PRODUCTS

1.1 MATERIALS

- A. Tee Wye Fitting: See Section 15060.

- B. Rigid and Flexible Ground Pipe Coupling: See Section 15060.
- C. Steel Pipe, Nipples, Couplings, Caps, and Fittings: See Section 15060.
- D. Vacuum Gauge Assemblies: See Section 15980.
- E. Water Extraction Straw: See Section 15060.
- F. Level Sensors: See Section 15980.
- G. Foot Valve: See Section 15060.
- H. Straw Centralizer: 4" x 1" S.S. nylon construction or other material compatible with a 1.5% toluene concentration in air. Shall fit firm and snug within well casing and have an open web spider configuration such that cause minimal soil gas flow restriction will occur. Johnson Type 304 Centering or equal.
- I. Adjustable Tethering Cable Assembly: 1/8" 7 x 19 Strand Core Type 304 S.S. Wire Rope, McMaster Carr Supply Co., Part No. 3461T65, or equal. Contractor shall submit shop drawing of Tethering Assembly showing proposed cable connections to 6" pipe cap and 5 lb weight, as well as ground wire connection and level sensors. Assembly to allow for easy adjustability of level sensor elevations and spacing.

PART 2 EXECUTION

2.1 INSTALLATION

- A. Install all equipment in accordance with manufacturer's instructions (where applicable), as shown on the contract drawings and per approved shop drawings.
- B. Electrical Connections: Refer to Section 16A.
- C. Insulate and heat trace well head providing means for access to key components, such as level sensors, extraction straw, and conduit box. Pressure gauge face must be visible (backmounted face is unacceptable). Refer to Sections 15260 and 16C5.

2.2 TOLERANCES

- A. Initial level sensor settings and water extraction straw setting shall be within ± 1 inch of settings as shown on the contract drawings.
- B. Plumbness and alignment shall be sufficient to allow proper operation, access and removal, installation, and inspection of all components.

2.3 TESTING

- A. Notify Engineer 3 days prior to testing.
- B. Test all grooved joints in accordance with grooved fitting manufacturer's requirements.
- C. Verify level sensor continuity and function.

2.4 CLEANING

- A. Clean piping in preparation for testing.

END OF SECTION

SECTION 02672
GROUNDWATER EXTRACTION WELL MODIFICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modifying existing well VE-7 for groundwater extraction.
- B. Water and system testing and certification.

1.2 RELATED SECTIONS

- A. Section 15060 - SVE Piping and Appurtenances
- B. Section 15140 - Supports and Anchors
- C. Section 15260 - Piping Insulation
- D. Section 16111 - Conduit
- E. Section 15980 - Functional Description and Instrumentation and Controls

1.3 REFERENCES

- A. Refer to 1.2 Related Sections.

1.4 SYSTEM DESCRIPTION

- A. One monitoring well (VE-7) will be modified as specified by the Contract Drawings. The well will be fitted with a Pitless Adaptor to facilitate installation of a 4" submersible pump, as well as the required interfacing with 1" drop and discharge piping. The Pitless Adaptor will also provide access for installation and adjustment of level sensing equipment required to facilitate extraction and discharge of groundwater from well VE-7 to the common 2" groundwater discharge piping. This common discharge pipe will combine contaminated groundwater flows from the VE-7 and the other SWMU-11 extraction wells and deliver it to equalization tank #2. The well will also be provided with a throttling valve and pressure gauge assembly on the 1" aboveground discharge piping to allow for required adjustment of the submersible pump.

Intrinsically-safe water level sensors will be installed into the well to provide a control signal to the control panel in order to start and stop the submersible pump

and control the pumping level. None Aqueous Phase Liquid (NAPL) is not anticipated to be encountered.

1.5 SUBMITTALS FOR REVIEW

- A. Section 1E4 - Shop Drawing Submittal and Correspondence Procedure
- B. Product Data: Include data indicating rated capacities, performance curves, working pressure, materials of construction, and accessories.
- C. Pumping Test: Results of pumping test data for the purpose of verifying the pump's performance only.

1.6 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Assembly, and installation instructions in accordance with provisions of Section 1E4.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section - 1I2 - Record Documents

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with references identified in sections listed in 1.2 Related Sections.
- B. Submit proof of state well drillers/pump installers license to perform this work.

1.9 SEQUENCING

- A. Sequence Work to occur before placement of water and discharge piping interconnecting the groundwater extraction well with the VES trailer.

PART 2 HARDWARE AND EQUIPMENT

2.1 SUBMERSIBLE PUMP: Manufacturer/Model: Grundfos Redi-Flo4 5E3 Environmental pump complete with Grundfos Environmental Motor and 1" FNPT Discharge. Motor Data: 1/3 HP, 3450 RPM, 230 VAC, single phase, 60 Hz with a 1.75 service factor.

2.2 PITLESS ADAPTER: Manufacturer: Baker, Evansville, Wisconsin
Model: SA4X1 Snappy Pitless Adapter

Provides clearance for installation of a 4" pump within 4" casing, as well as providing a connection between the 1" drop pipe and 1" discharge piping. Other types acceptable if they meet the requirements of the application.

- 2.3 RIGID AND FLEXIBLE GROOVED PIPE COUPLING: See Section 15060.
- 2.4 STEEL PIPE, NIPPLES, COUPLINGS, CAPS, AND FITTINGS: See Section 15060.
- 2.5 PRESSURE GAUGE ASSEMBLY: See Section (? C&I).
- 2.6 DROP PIPE: 1" Sch. 40 black steel, straight threaded and coupled.
- 2.7 LEVEL SENSORS: See Section (? C&I).
- 2.8 CHECK VALVE: Tag No. FV-069 - See Section 15060.
- 2.9 LEVEL SENSOR MOUNTING DETAILS: 1/8" 7 x 19 Strand Core Type 304 S.S. Wire Rope, McMaster Carr Supply Co., Part No. 3461T65, or equal. Contractor shall submit shop drawing showing proposed level sensor mounting details, as well as ground wire connection to the drop pipe. Sensor mounting detail to allow for easy adjustability of level sensor elevations and spacing.
- 2.10 WELL SEAL: 4" x 1" Grundfos Well Seal or equal. Plug drop pipe penetration and utilize wire parts only for motor wire and level sensor conduction access.
- 2.11 LINK SEAL: Line-Seal by Thunderline Corp., Belleville, MI. Provide correct selection for sealing annular space between ID of 3" Sch. 40 Steel Pipe and OD at 1" Sch. 40 Steel Pipe.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01041.

3.2 PREPARATION

- A. Protect structures near the well from damage.

3.3 INSTALLATION

- A. Install all equipment in accordance with manufacturer's instructions (where applicable).
- B. Electrical Connections: Refer to Section (Elec.?)
- C. Adjust throttling valve such that pump operates within manufacturer's acceptable range while discharging into system during condition of pumping with and without SVE groundwater pump system activation.

3.4 TOLERANCES

- A. Initial level sensor settings and water extraction straw setting shall be within ± 1 inch of settings as shown on the contract drawings.
- B. Plumbness and alignment shall be sufficient to allow for proper operation, drawings, access and removal, installation, and inspection of all components.

3.5 TESTING

- A. Notify Engineer 3 days prior to testing.
- B. Perform Hydrostatic Leak Test on all piping and fittings.
- C. Perform Start Pump Test and obtain 3 data points minimum (Discharge Pressure, Flow Rate) to verify pump performance.

3.6 CLEANING

- A. Clean piping in preparation for testing.

END OF SECTION

SECTION 02800 FENCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install fencing around the groundwater forcemain, SVE forcemain and all above-grade piping as shown on the drawings.

1.2 RELATED SECTIONS

- 1. Section 03300, Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

- A. Erector Qualifications: Erector must be a firm experienced in the erection of fencing of the type specified.
- B. Design Criteria: Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and Federal Specification RR-F-191 (latest revision), unless otherwise shown or specified.
- C. Source Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless.
 - 2. ASTM A 121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 - 3. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - 5. Chain Link Fence Manufacturer's Institute, Galvanized Steel Chain-Link Fence Fabric.

6. Federal Specification, RR-F-191 (latest revision), Fencing, Wire and Post, metal (Chain-Link Fence Fabric).

1.4 SUBMITTALS

A. Samples: Submit for approval the following:

1. Approximately 6 inches long, or 6 inch square of fabric material, framework members, and typical accessories, in a full range of manufacturer's standard and custom colors. ENGINEER's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, footings, operators, hardware list and erection procedures.
2. Copies of manufacturer's technical data test reports on physical properties, and installation instructions for steel fences and gates.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver material in manufacturer's original packaging with all tags and labels intact and legible.

B. Handling of Materials: Handle and store material in such manner as to avoid damage.

PART 2 PRODUCTS

2.1 GENERAL

A. Pipe sizes specified are commercial pipe sizes.

B. Tube sizes specified are nominal outside dimension.

C. Rolled-formed section sizes are the nominal outside dimensions.

D. Finish for Framework and Appurtenances: Furnish the following finishes for steel framework and appurtenances:

1. Galvanized finish with minimum weights of zinc as follows:

- a. Pipe: ASTM A 53, Schedule 40, 1.8 ounce zinc per square foot.
- b. Hardware and Accessories: ASTM A 153, zinc weight per Table I, Federal Specification RR-F-191 (latest revision).

2.2 FABRIC

- A. Furnish chain link fabric as follows:
 - 1. One-piece fabric widths, for fence heights up to 12 feet.
 - a. No. 9 gage wires.
 - 2. Top salvages twisted and barbed and bottom selvage knuckled for fabric cover 60 inches high.
 - 3. Top and bottom salvages knuckled for 1-3/4-inch and 1-inch fabric.
 - 4. Galvanized finish with not less than 2.0 ounces zinc per square foot complying with ASTM A 392, Class II.

2.3 POSTS, RAILS AND BRACES

- A. End, Corner, and Pull Posts: Furnish end, corner, and pull posts of the minimum sizes and weights as follows:
 - 1. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.
- B. Line Posts: Furnish line posts of the minimum sizes and weights as follows. Space posts 10 feet on centers maximum, unless otherwise shown.
 - 1. Over 6 feet fabric height:
 - a. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.
- C. Gate Posts: Furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
 - 1. Over 13 feet and up to 18 feet wide:
 - a. 6.625 inches OD pipe weighing 18.97 pounds per linear foot.

- D. Center Rails Between Line Posts: Furnish center rails between line posts where indicated, consisting of 1.660 inch OD pipe weighing 1.35 pounds per linear foot.
- E. Post Brace Assembly: Furnish bracing assemblies at end and gate posts at both sides of corner and pull posts, with the horizontal brace located at mid-height of the fabric.
1. Use 1.660 inch OD pipe weighing 1.35 pounds per linear foot for horizontal brace and 3/8 inch diameter rod with turnbuckle for diagonal truss.
- F. Tension Wire: Furnish tension wire consisting of aluminized 7 gage coiled spring wire.
1. Locate at bottom of fabric only.
- G. Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to posts attaching 3 rows of barbed wire to each arm. Supporting arms shall be integral with post top weather cap. Provide following type:
1. Single vertical arm, one for each post where shown.
- H. Barbed Wire: 2 strand, 11 gage wire with 14 gage, 4-point aluminum barbs spaced 5 inches on center, as follows:
- I. Post Tops: Pressed steel, wrought iron, or malleable iron, designed as a weathertight closure cap, for tubular posts. Furnish one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required
1. Furnish caps with openings to permit through passage of the top rail.
- J. Stretcher Bars: One piece lengths equal to full height of fabric, with a minimum cross-section of 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into the post.
- K. Stretcher Bar Bands: Steel, galvanized, 0.078 to 0.108 inches thick depending on post diameter, spaced not over 15 inches on center to secure stretcher bars to end, corner, pull, and gate posts.
1. Bands may also be used with special fittings for securing rails to end, corner, pull and gate posts.

2.4 GATES

- A. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8 feet apart. Fabricate as follows:
 - 1. Up to 6 feet high, or leaf width 8 feet or less:
 - a. 1.660 inch OD pipe weighing 1.80 pounds per linear foot
 - 2. Over 6 feet high, or leaf width exceeding 8 feet:
 - a. 1.90 inch OD pipe weighing 2.72 pounds per linear foot.
- B. Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means which will provide security against removal or breakage.
- C. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.
 - 1. Where barbed wire is shown above gates, extend the end members of gate frames 1 foot-0 inch above the top member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- D. Gate Hardware: Furnish the following hardware and accessories for each gate.
 - 1. Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 feet nominal height.
 - 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 - 3. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
 - 4. Double Gates: Provide gate stops for double gates, consisting of much room type or flush plate with anchors. Set in concrete to engage the center drop rod or

plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.

2.5 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Wire Ties: For tying fabric to line posts, use 9 gage wire ties spaced 12 inches on center. For tying fabric to rails and braces, use 9 gage wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center. Finish of ties to match fabric finish.

- 1. Manufacturer's standard procedure will be accepted if of equal strength and durability.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the conditions under which the fence and gates are to be installed and notify CONTRACTOR in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to CONTRACTOR.

3.2 PREPARATION

- A. Do not begin fence installation and erection before the final grading is completed, with finish elevations established.

3.3 INSTALLATION

- A. Install framework, fabric and accessories in accordance with ASTM F 567.
- B. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.
 - 1. If not shown on the Drawings, excavate holes to the minimum diameters as recommended by fence manufacturer.
 - 2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than the post bottom, with bottom of posts set not less than 36 inches below the surface when in firm, undisturbed soil.

- a. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site, as directed.
- C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
 - 1. Center and align posts in holes 3 inches above bottom of excavation.
 - 2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - 3. Trowel finish tops of footings, and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.
 - 4. Keep exposed concrete surfaces moist for at least 7 days after placement, or cure with membrane curing materials, or other acceptable curing method.
- D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.
 - 1. Take samples and test concrete to determine strength as specified in concrete sections of Division 3.
- E. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- F. Center Rails: Provide center rails only where shown. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- G. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- H. Tension Wire: Install tension wires by weaving through the fabric and tying each post with not less than 6 gage galvanized wire, or by securing the wire to the fabric.
- I. Fabric: Leave approximately 2 inches between finish grade and bottom selvage, except where bottom of fabric extends into concrete. Pull fabric taut and tie to posts, rails,

and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

- J. Repair coatings damaged in the shop or during field erection by recoating with manufacturer's recommended repair compounds, applied per manufacturer's direction.
- K. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.
- L. Barbed Wire: Install 3 parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fasten securely to each extension arm.
- M. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.
- O. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
- P. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust all fencing and gates and leave in good working condition.
- B. Repair or replace any broken or bent components as directed by the CONTRACTOR.
- C. Protect gates and fencing from construction traffic until acceptance of the Work.

END OF SECTION 02800

SECTION 03010 GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install grout at all equipment bases, handrails and railings, and construction joints. The types of grout include non-shrink, epoxy types, non-shrink, non-metallic type, and ordinary cement-sand.

1.2 RELATED SECTIONS:

1. Section 03300, Cast-in-Place Concrete.
2. Section 04100, Mortar
3. Section 05120, Structural Steel.
4. Section 05520, Aluminum Handrails and Railings.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 1. ASTM C 144, Aggregate for Masonry Mortar.
 2. ASTM C 150, Portland Cement.
 3. ASTM C 109, Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50 mm. Cube Specimens)
 4. ASTM C 191, Time of Setting of Hydraulic Cement by Vicar Needle.
 5. CRD-C-588, Specifications for Non-Shrink Grout.
 6. CRD-C-619, Specification for Grout Fluidifier.

1.4 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:

1. Manufacturer's specifications and installation instructions for all proprietary materials.
 2. For ordinary cement grout, submit copies of grout design mix and laboratory test reports for grout strength tests.
- B. Reports and Certificates:
1. For proprietary materials, submit copies of reports on quality control tests.
 2. For nonproprietary materials, submit certification that materials meet specification requirements.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Grout materials from manufacturers shall be delivered in unopened containers and shall bear intact manufacturer's labels.
- B. Storage of Materials: Grout materials shall be stored in a dry shelter and shall be protected from moisture.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Non-metallic, 100 percent solids, high strength epoxy grout.
1. Use clean well graded sand with epoxy resins suitable for use on dry or damp surfaces.
 2. Product and Manufacturer: Provide one of the following:
 - a. Euco High Strength Grout by The Euclid Chemical Company.
 - b. Sikadur 42 Grout by Sika Chemical Company.
 - c. Five Star Epoxy Grout by U.S. Grout Corporation.
- B. Non-Shrink, Non-Metallic Grout:
1. Pre-mixed non-staining cementitious grout requiring only the addition of water at the jobsite.

2. Product and Manufacturer: Provide one of the following:
 - a. Euco N-S by The Euclid Chemical Company.
 - b. Masterflow 713 by Master Builders Company.
 - c. Sika Grout 212 by Sika Chemical Company.
- C. Ordinary Cement-Sand Grout: Prepare design mixes of ordinary cement grout. Mixes subject to the following limitations:
 1. Cement:
 - a. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
 2. Aggregates: ASTM C33 and as herein specified.
 - a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - b. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - 1) Dune sand, bank run sand and manufactured sand are not acceptable.
 - c. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - 1) Crushed stone, processed from natural rock or stone.
 - 2) Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
 - 3) Coarse Aggregate Size: Size to be ASTM C33, Nos. 7 for Class "B" grout. Coarse aggregate not permitted in Class "A" grout.
 3. Admixtures: Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures, which have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER. Refer to Section 03300 for additional admixtures requirements.

4. Proportioning and Design of Mixes: Prepare design mixes for each glass of grout. Mixes subject to the following limitations:
 - a. Class "A" Grout:
 - 1) Specified 28-day Compressive Strength: 4,000 psi.
 - 2) Maximum Water-Cement Ratio by Weight: 0.45.
 - 3) Fine Aggregate meeting ASTM C33.
 - 4) Air Content Percentage: $9 \pm 1\%$.
 - 5) Minimum Cement Content in Pounds per Cubic Yard: 658.
 - b. Class "B" Grout:
 - 1) Specified 28-day Compressive Strength: 3,000 psi.
 - 2) Maximum Water-Cement Ratio by Weight: 0.50.
 - 3) Fine and Coarse Aggregate (No. 7) meeting ASTM C33.
 - 4) Air Content Percentage: $7 \pm 1\%$.
 - 5) Minimum Cement Content in Pounds per Cubic Yard: 611.
5. Use an independent testing company acceptable to the ENGINEER for preparing and reporting proposed mix designs.
 - a. The testing company shall not be the same as used for field quality control testing unless approved by the ENGINEER.
6. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and report to the ENGINEER the following data:
 - a. Complete identification of aggregate source of supply.
 - b. Tests of aggregates for compliance with specified requirements.
 - c. Scale weight of each aggregate.

- d. Absorbed water in each aggregate.
 - e. Brand, type and composition of cement.
 - f. Brand, type and amount of each admixture.
 - g. Amounts of water used in trial mixes.
 - h. Proportions of each material per cubic yard.
 - i. Gross weight and yield per cubic yard of trial mixtures.
 - j. Measured slump.
 - k. Measured air content.
 - l. Compressive strength developed at 7 days and 28 days, from not less than 3 test specimens cast for each 7-day and 28-day test, and for each design mix.
- 7. Submit written reports to the ENGINEER of proposed mix of grout at least 30 days prior to start of Work. Do not begin grout production until mixes have been approved by the ENGINEER.
 - 8. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning. However, 4,000 psi mixes need not be designed for greater than 3,400 psi, regardless of the production facilities standard deviation.
 - 9. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Chapter 3.
 - 10. Admixtures: Use air-entraining admixture in all grout. Provide not less than 4-1/2 percent nor more than 7-1/2 percent entrained air. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control. Do not use admixtures which have not been incorporated and tested in the accepted design mix, unless otherwise authorized in writing by the ENGINEER.
 - 11. Slump Limits: Proportion and design mixes to result in grout slump at the point of placement of not more than 5 inches.

D. Water:

1. Use clean, fresh, potable water free from injurious amounts of oils, acids, alkalies or organic matter.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The CONTRACTOR and his installer shall examine the substrate and conditions under which grout is to be placed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until ENGINEER provides clarification.
2. Drypacking will not be permitted.
3. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.
4. Placing grout shall conform to temperature and weather limitations in Section 03300.

B. Columns, Beams and Equipment Bases:

1. After shimming equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates, allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the epoxy grout.
2. After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of

the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink, non-metallic grout.

C. Handrails and Railings:

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink, non-metallic grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Grout Fill Around Reinforcement in Masonry Work:

1. Provide ordinary Class "B" cement grout for grout fill in masonry lintels, bond beams and pilasters. Site mixing of grout is acceptable. Use of water-reducing admixture is not required.

END OF SECTION 03010

SECTION 03300 CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install cast-in-place concrete, reinforcement and related materials.
- B. General:
 - 1. Class "A" concrete shall be steel reinforced and includes the following:
 - a. Precast structures.
 - b. Other reinforced concrete structures.
 - 2. Class "B" concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following:
 - a. Concrete fill.
 - b. Curbs and gutters.
 - c. Sidewalks.
 - d. Encasements, etc.
 - 3. Steel Reinforcement: Includes bars, ties, supports and welded wire fabric.

1.2 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Concrete Testing Service:
 - a. CONTRACTOR shall employ acceptable testing laboratory to perform materials evaluation, testing and design of concrete mixes.
 - b. CONTRACTOR's laboratory shall also evaluate concrete delivered to and placed at the site.

- b. CONTRACTOR's laboratory shall also evaluate concrete delivered to and placed at the site.
 2. Certificates, signed by concrete producer and CONTRACTOR, may be submitted in lieu of material testing when acceptable to ENGINEER.
 3. Quality Control: Perform sampling and testing during concrete placement, as follows:
 4. Quality Control: CONTRACTOR's testing laboratory will perform sampling and testing during concrete placement, as follows:
 - a. Sampling: ASTM C 172.
 - b. Slump: ASTM 143, one test for each load at point of discharge.
 - c. Air Content: ASTM C 31, one for each set of compressive strength specimens.
 - d. Compressive Strength: ASTM C 39, one set for each 50 cubic yards or fraction thereof of each class of concrete; 1 specimen tested at 7 days, 2 specimens tested at 28 days.
 - 1) When the total quantity of concrete is less than 50 cubic yards, the strength tests may be waived by CONTRACTOR if field experience indicates evidence of satisfactory strength.
 5. Report test results in writing to ENGINEER on same day tests are made.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.

 1. ACI 301, Specifications for Structural Concrete for Building (includes ASTM Standards referred to herein except ASTM A 36).
 2. ACI 347, Recommended Practice for Concrete Formwork.
 3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
 4. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.

7. ASTM A 36, Structural Steel.
8. Concrete Reinforcing Steel Institute, Manual of Standard Practice, include ASTM Standards referenced herein.

1.3 SUBMITTALS

- A. Samples: Submit samples of materials as specified and may be requested by ENGINEER including names, sources and descriptions.
- B. Shop Drawings: Submit for approval the following:
 1. Copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Chapters 1 thru 8. For walls, show elevations to a minimum scale of 1/4 inch to 1 foot. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement.
 3. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs in accordance with ACI 301, 3.9. Submit written report to ENGINEER for each proposed concrete mix at least 15 days prior to start of Work. Do not begin concrete production until mixes have been reviewed and are acceptable to ENGINEER. Mix designs may be readjusted when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by ENGINEER.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. ENGINEER'S review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of CONTRACTOR.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to insure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Aggregates: ASTM C 33.
 - 1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.
 - 2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay mud, loam or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
- C. Coarse Aggregate Size: Size to be ASTM C 33, Nos. 57 or 67, unless permitted otherwise by ENGINEER.
- D. Water: Clean, drinkable.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Water-Reducing Admixture: ASTM C 494. Only use admixtures which have been tested and accepted in mix designs.

2.2 FORM MATERIALS

- A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.
- B. Exposed Concrete Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces. Use largest practical sizes to minimize form joints.
- C. Unexposed Concrete Surfaces: Suitable material to suit project conditions.
- D. Provide 3/4-inch chamfer at all exposed corners.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60.
 - 1. Bars noted on plans to be epoxy-coated shall be coated with Scotch-kote Brand Fusion Bonded Epoxy Coating 213 or 214 as manufactured by 3M, St. Paul Minnesota. Coating shall be applied to cleaned steel reinforcing bars by the electrostatic spray method and fully cured in accordance with the recommendations of the manufacturer of the coating material. Before coating, the bars shall be cleaned by abrasive blast cleaning to meet the requirements of near white metal in accordance with SSPC-SP10. The Coating shall be applied to the cleaned surface as soon as possible after cleaning, and before oxidation of the surface discernable to the unaided eye occurs. However, in no case shall application of the coating be delayed more than 8 hours after cleaning. The film thickness of the coating after curing shall be 5 to 20 mils, inclusive, as measured using ASTM G 12 on the body of the reinforcing bar between the deformations and/or ribs on a straight length of bar. The coating shall be free from holes, voids, cracks, and damaged areas discernable to the unaided eye. Damaged or other unsatisfactory areas shall be patched with a coring material and by a method recommended by the coating manufacturer.
- B. Welded Wire Fabric: ASTM A 185.
- C. Steel Wire: ASTM A 82.
- D. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 - 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.

2. For slabs on grade, use supports with sand plates or horizontal runners where base materials will not support chair legs.
3. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI, Manual of Standard Practice as follows:
 - a. Either hot-dip galvanized, plastic protected or stainless steel legs.
4. Over waterproof membranes, use precast concrete chairs.

2.4 RELATED MATERIALS

A. Waterstops:

1. Flat dumbbell or centerbulb type, size to suit joints, of Polyvinyl Chloride.
 - a. Manufacturer: Provide waterstops of one of the following:
 - 1) W.R. Meadows, Incorporated.
 - 2) A.C. Horn, Incorporated.

B. Membrane-Forming Curing compounds: ASTM C 309, Type I.

C. Epoxy Bonding Agent:

1. Two-component epoxy resin bonding agent.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Sikadur Hi-Mod by Sika Chemical Corporation.
 - 2) Epoxitime Binder (Code No. 2390) by A.C. Horn, Incorporated.

D. Joint Fillers: See Section 7J.

2.5 MOISTURE BARRIER

A. Moisture Barrier: ASTM E 154:

1. Provide moisture barrier cover over prepared base material where indicated. Use polyethylene membrane not less than 8 mils thick, lapping at least 9 inches at joints.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 FORMWORK

- A. Formwork: Construction so that concrete members and structures are correct size, shape, alignment, elevation and position, complying with ACI 347.
- B. Provide openings in formwork to accommodate Work of other trades. Accurately place and securely support items built into forms.
- C. Tie holes shall be filled immediately after form removal. The cavities shall be cleaned, thoroughly dampened, and filled solid with mortar. Where appearance is essential, they shall be finished to match the surrounding surface. A bonding coat and curing is not required.

3.3 REINFORCEMENT, JOINTS, AND EMBEDDED ITEMS

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reducer or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
 - 1. Place reinforcement to obtain the minimum concrete coverage as shown and as specified in ACI 318. Arrange, space, and securely tie bars and bar supports together with 61 gage wire to hold reinforcement accurately in position during concrete placement operations. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
 - 2. Reinforcing steel shall not be secured to forms with wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed

concrete surfaces.

- D. Provide sufficient numbers of supports of strength required to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- E. Splices:
 - 1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.
- F. Install welded wire fabric in as long lengths as practical, lapping at least one mesh.
- G. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.
- H. Joints: Provide construction, isolation, and control joints as indicated on drawings or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs on ground to stabilize differential settlement and random cracking.
- I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates, and instruction provided under other Sections and other contracts for locating and setting. Refer also to Paragraph 1.1.B., Coordination, above.

3.4 CONCRETE AND PLACEMENT

- A. Proportioning and Design of Mix:
 - 1. Minimum compressive strength at 28 days: 4000 psi.
 - 2. Maximum water cement ratio by weight: 0.45.
 - 3. Minimum cement content: 564 pounds per cubic yard.
 - 4. Normal weight: 145 pounds per cubic foot.
 - 5. Use air-entraining admixture in all concrete: provide not less than 4 percent nor

more than 8 percent entrained air for concrete exposed to freezing and thawing, and from 2 percent to 4 percent for other concrete.

6. Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride.
- B. Mob-Site Mixing: Use drum type batch machine mixer, mixing not less than 1-1/2 minutes for one cubic yard or smaller capacity. Increase mixing time at least 15 seconds for each additional cubic yard or fraction thereof.
- C. Ready-Mixed Concrete: ASTM C 94.
- D. Concrete Placement: Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.
- E. Consolidate placed concrete using mechanical vibrating equipment with hand ridding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms.
- F. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement, and curing.
 1. In cold weather comply with ACI 306.
 2. In hot weather comply with ACI 305.

3.5 QUALITY OF CONCRETE WORK

- A. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
- B. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
- C. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER surfaces which contain cracks or voids, or are unduly rough, or are in any way defective. Patches or plastering will not be acceptable.
- D. Repair, removal, and replacement of defective concrete as ordered by ENGINEER shall be at no additional cost to OWNER.

3.6 CURING

- A. Curing: Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces.

3.7 FINISHES

A. Finish:

1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Use a wood float only. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.
2. After floating, begin the first trowel finish operating using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
3. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10-foot straight edge. Grind smooth surface defects which would telegraph through applied floor covering system.
4. Use trowel finish fore the following:
 - a. Interior exposed slabs unless otherwise shown or specified.
5. Apply non-slip broom finish to the exterior concrete slab and elsewhere as shown on the Drawings.

- B. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with manufacturer's instructions.

3.8 GROUT PLACEMENT

A. General:

1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until CONTRACTOR provides clarification.
2. Drypacking will not be permitted.
3. Manufacturers of proprietary products shall make available upon 72 hours notification the services of qualified, full-time employee to aid in assuring proper use of the product under job conditions.
4. Placing grout shall conform to the temperature and weather limitations described in Article 3.4 above.

END OF SECTION 03300

**SECTION 04150
MASONRY ACCESSORIES**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish all masonry accessories Work including, but not necessarily limited to: continuous horizontal wire reinforcing and ties, individual wire ties, anchoring devices, and miscellaneous masonry accessories.

1.2 RELATED SECTIONS

- 1. Section 04100, Mortar.
- 2. Section 04200, Unit Masonry Construction.
- 3. Section 05120, Structural Steel.
- 4. Section 05500, Miscellaneous Metal Fabrications.
- 5. Section 09900, Painting.

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour and similar designations), provide masonry accessories complying with the requirements established by UL and other governing authorities.
- B. Codes: Comply with the applicable requirements of the State of Rhode Island Official Compilation of Codes, Rules and Regulations for types of masonry accessories Work shown and specified.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 - 1. ASTM A 82, Cold-Drawn Steel Wire for Concrete Reinforcement.
 - 2. ASTM A 153, Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
 - 3. ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

4. ASTM AA 663, Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
5. ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
6. UL, Design Numbers U901 through U908.

1.4 SUBMITTALS

A. Samples: Submit for approval the following:

1. 6-inch lengths of each item specified and one of each individual item.
2. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements, and where each masonry accessory shall be used in the Work.
2. Explain where each masonry accessory will be used in the Work and the intended spacing.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver accessories in original packages, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials: Store and cover materials to prevent corrosion and deterioration.

PART 2 PRODUCTS

2.1 MATERIALS

A. Continuous Horizontal Wire Reinforcing and Ties for Masonry: Provide the following unless otherwise shown:

1. General: Welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner "L" and intersection "T" units. Fabricate from cold-

drawn steel wire complying with ASTM A 82, with deformed continuous 9 gage side rods and plain 9 gage cross rods, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition. All reinforcing and ties shall be hot dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-1 and B-2 unless otherwise specified.

2. For single-wythe and multi-wythe masonry, use units fabricated as follows:

- a. Truss-type fabricated with one horizontal rod beneath each unit masonry shell wall and continuous diagonal cross-rods spaced not more than 16 inches on centers.
- b. Product and Manufacturer: Provide one of the following:
 - 1) Blok-Trus AA600 and 3-Wire Blok-Trus by AA Wire Products Company.
 - 2) Or equal.

B. Individual Wire Ties for Masonry: Provide the following where shown:

- 1. General: Fabricate from 3/16 inch cold-drawn steel wire complying with ASTM A 82, with 1.5 ounces per square foot of hot-dip coating complying with ASTM A 153, Class B-3 with unit width of 1-1/2 to 2 inches less than thickness of wall or partition.
- 2. Where facing and back-up joints align use single-piece ties as follows:
 - a. For use with hollow masonry units laid with cells vertical, provide 4-inch wide rectangular shaped ties.
 - b. For use with solid masonry units or hollow units laid with cells horizontal, provide ties with ends bent to 90 degree angles to form hooks not less than 2-inches long.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) AA309 Wire or AA304 Rectangular Wire Tie by AA Wire Products Company.
- 3. Where facing and back-up joints do not align, use adjustable two-piece ties as follows:

- a) For use with hollow masonry units laid with cells vertical, and with solid masonry units or hollow units laid with cells horizontal provide 4-inch wide adjustable rectangular shaped ties with lock bars welded across box ties and adjustable ties with ends bent to 90 degree angles to form box ties not less than 2-inches long. Eye-type units are not acceptable and shall not be approved by CONTRACTOR.
- b) Product and Manufacturer: Provide one of the following:
 - 1) AA301 Adjustable U-Bar and Rectangular Box Ties by AA Wire Products Company.

C. Anchoring Devices for Masonry: Provide the following unless otherwise shown:

1. General:

- a. Unless otherwise specified all anchoring devices for masonry shall be hot dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-1, B-2 and B-3.
- b. Flexible Anchors: Whenever masonry abuts structural walls or framework provide flexible anchors which permit horizontal and vertical movement of masonry but provides lateral restraint.

2. For anchorage to concrete structure provide the following:

- a. Two-piece anchors with 24 gage sheet metal dovetail and 16 gage rectangular corrugated tie 1-inch wide, sized to extend to within one inch of face of masonry.
- b. Product and Manufacturer: Provide one of the following:
 - 1) No. AA100 Dovetail and AA205 Anchors by AA Wire Products Company.

3. For anchorage to steel framework provide the following:

- a. Two-piece anchors with 8-inch long channel slot fabricated from 11 gage steel and 16 gage rectangular corrugated 1-inch wide tie sections sized to extend within one inch of opposite face of masonry, to a depth of 12 inches abutting flanges, or between 1-1/2 inch and 2 inches less than width of masonry abutting web.

b. Product and Manufacturer: Provide one of the following:

- 1) No. AA209 Channel and AA210 Tie by AA Wire Products Company.

D. Miscellaneous Masonry Accessories: Provide the following where shown:

1. Reinforcing Bars:

- a. Deformed carbon steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18 except as otherwise shown.
- b. Plain carbon steel, ASTM A 663, Grade 80 where No. 2 bars are shown or required.
- c. Provide galvanized steel reinforcing bars complying with ASTM A 153, Class B-1, where shown.

2. Compressible Filler:

- a. Use foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50 percent of its original volume, filler shall hold six feet of water hydrostatically, and 10 feet at 60 percent compression. Filler shall maintain its resiliency to allow for installation in temperatures as low as 40°F. Filler shall be waterproof when compressed to 50 percent of its original volume in temperatures from -40°F to +200°F. Elongation shall be at least 325 percent with a tensile strength of not less than 53 pounds per square inch. No migration of polybutylene compound in the polyurethane strip will be allowed.

b. Product and Manufacturer: Provide one of the following:

- 1) Polytite by Sandell Manufacturing Company.
- 2) Compriband by Secoa Corporation, Division of Phoenix Building Products, Incorporated.

3. Premolded Control Joint Strips: Solid polyvinyl chloride strips with a Shore A durometer hardness of 80 to 90, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration shall be as specified.

a. Product and Manufacturer: Provide one of the following:

- 1) Blok-Tite AA2003 and AA2005 by AA Wire Products Company.

4. Sealants: Section 7J1, Calking and Sealants.
5. Cavity Fill Mesh: Provide hot dip galvanized 1/2-inch mesh hardware cloth, backed with asphalt impregnated cloth below. Install below all block courses that are to be filled with mortar.

2.2 FABRICATION

- A. Weld-in-place all channel slots and other specified weld-on anchors at the shop. Field welding is not acceptable.
- B. Coordinate location of all weld-on anchors and show on structural steel Shop Drawings included under Section 5A3, Structural Steel.
- C. Weld anchor slots and other required accessories in place before shop priming of structural steel.
- D. Prime all weld-on anchors and other accessories and passivate anchor coating as required and specified under Section 9L, Painting.
- E. Shop-fabricate reinforcing bars which are shown or required to be bent or hooked. Comply with ACI 315 for the fabrication of reinforcing steel for unit masonry construction Work.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Refer to the following:
 1. Section 04200, Unit Masonry Construction.

END OF SECTION 04150

**SECTION 04200
UNIT MASONRY CONSTRUCTION**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Providing openings in unit masonry construction to accommodate the Work under this and other Sections and building into the unit masonry construction all items such as sleeves, anchor bolts, inserts and all other items to be embedded in unit masonry construction for which placement is not specifically provided under other Sections.
- B. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the unit masonry construction Work.
 - 2. Unit masonry construction Work advanced without built-in flashing and other built-in Work shall be removed and rebuilt at no additional expense to OWNER even if discovered after unit masonry construction Work has been completed.
 - 3. Coordinate the Work of other Sections to avoid delay of the unit masonry construction Work.

1.2 RELATED SECTIONS

- 1. Section 04100, Mortar.
- 2. Section 04150, Masonry Accessories.
- 3. Section 05500, Miscellaneous Metal Fabrications.
- 4. Section 06100, Rough Carpentry.

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction Work (4-hour, 3-hour, and similar designations), comply with applicable requirements for materials and installation established by UL and other governing authorities.
- B. Codes: Comply with the applicable requirements of the State of Rhode Island Official Compilation of Codes, Rules and Regulations for the types of unit masonry construction Work shown.

C. Construction Tolerances:

1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4 inch in 10 feet, or 3/8 inch to a story height or 20 feet maximum, nor 1/2 inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4 inch in any story or 20 feet maximum, nor 1/2 inch in 40 feet or more.
2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.
3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed 1/2 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.
4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.

D. Job Mock-up:

1. Prior to installation of unit masonry construction Work, but after ENGINEER's approval of samples, erect job mock-up using materials, pattern bond and joint tooling shown or specified for final Work. Provide special features as directed including finished opening 1 foot-4 inches by 1 foot-4 inches, finished end, and masonry control joint. Build mock-up at the site, in location approved by ENGINEER, of full required wall thickness and approximately 4 feet by 3 feet-4 inches, unless otherwise shown. Indicate the proposed range of color, texture and workmanship to be expected in the completed Work. Obtain ENGINEER's acceptance of visual qualities of the mock-up before start of unit masonry construction Work. Retain and protect mock-up during construction as a standard for judging completed unit masonry construction Work. Do not alter, move or destroy mock-up until given written permission by ENGINEER.
2. Build as many job mock-up panels as required to obtain ENGINEER'S acceptance of the Work.
3. Unit masonry construction Work which proceeds without an approved job mock-up panel shall be removed.
4. Masonry construction that does not meet the standards approved on the sample panel shall be removed and rebuilt as required by ENGINEER. Provide mock-up panel or the following:

- a. Typical complete exterior wall including elastic masonry flashing.
- b. Typical complete interior wall of glass unit masonry.

E. Preconstruction Conference:

1. Prior to the installation of unit masonry construction Work, CONTRACTOR shall schedule a preconstruction conference at the project site. Review foreseeable methods and procedures related to the unit masonry construction Work including, but not necessarily limited to, the following:
 - a. Project requirements, including Drawings, Specifications and other Contract Documents.
 - b. Structural concept.
 - c. Method of sequence of masonry construction.
 - d. Special masonry details.
 - e. Required submittals, both completed and yet to be completed.
 - f. Standard of workmanship.
 - g. Quality control requirements.
 - h. Job organization and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - i. Masonry control and expansion joint location and materials.
 - j. Modular planning requirements.
 - k. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - l. Required inspection, testing and certifying procedures.
 - m. Regulations concerning building code compliance.

F. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 67, Standard Methods of Sampling and Testing Brick.
2. Brick Institute of America, "Technical Notes on Brick and Tile Construction."
3. Brick Institute of America, Technical Bulletin 1A. "Construction and Protection Recommendations for Cold Weather Masonry Construction."
4. Brick Institute of America, Technical Notes on "Cleaning Clay Products Masonry."
5. National Concrete Masonry Association, "guide Specifications" and "Technical Bulletins."

1.4 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Provide plans and elevations drawn at 1/4 inch scale and details drawn at 1-1/2 inch scale. Show all items required to be built into unit masonry construction Work.
2. Masonry control joint locations and details.
3. Shop Drawings showing the location, extent and accurate configuration and profile of all items shown, specified and required by this and other sections to be built into the unit masonry construction Work as the Work progresses. Provide elevations drawn at 1/4 inch scale and all details drawn at 1-1/2 inch scale.
4. Shop Drawing for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for unit masonry construction Work.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver reinforcing to the site, bundled, tagged and marked. Use metal tags indicating size, lengths and other markings shown on approved Shop Drawings.

B. Storage of Materials:

1. Protect masonry materials during storage and construction with a properly erected shelter from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.
2. Maintain temperatures in shelter so that masonry materials are above 20°F when laid.

C. Handling Materials:

1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished Work.

1.6 JOB CONDITIONS

A. Site Facilities: Supplemental heat sources as may be required should CONTRACTOR wish to continue unit masonry construction Work in cold weather are not available at the project site. The provision of all supplemental heat energy sources and equipment is the responsibility of CONTRACTOR.

B. Environmental Requirements:

1. Do not place any unit masonry construction Work when air temperature is below 28°F on a rising temperature or below 36°F on falling temperatures without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing as specified in 1.5.C below.
2. No frozen materials shall be used nor shall frozen unit masonry construction Work be built upon.
3. Remove and replace all unit masonry construction Work damaged by frost or freezing.

C. Protection:

1. Protect all unit masonry construction Work against freezing for at least 48 hours after being placed.
 - a. Mean Daily Air Temperature 40°F to 32°F: Protect unit masonry construction Work from rain or snow for 48 hours after installation.
 - b. Mean Daily Temperature 32°F to 25°F: Completely cover unit masonry construction Work for 48 hours after installation.

- c. Mean Daily Temperature 25°F to 20°F: Completely cover unit masonry construction Work with insulating blankets for 48 hours.
 - d. Mean Daily Temperature 20°F and Below: Maintain unit masonry construction Work above 32°F for 48 hours by enclosure and supplementary heat.
- 2. Protect partially completed masonry against rapid heat loss and from water entering masonry, when Work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2 feet down both sides of walls and secure in place using wall cover clamps spaced at intervals of 4 feet-0 inches and at each end and joint of covering.
 - 3. Do not apply uniform floor or roof loading for at least three days after completing masonry columns or walls.
 - 4. Do not apply concentrated loads for at least seven days after completing masonry columns or walls.

D. Cold Weather Unit Masonry Construction Work:

- 1. All mortar for use in unit masonry construction Work when the mean daily temperature is below 40°F shall be portland cement-lime-sand mortars using high early strength portland cement.
- 2. Clay or shale unit masonry with suction in excess of 20 grams per 30 square inches shall be sprinkled with heated water just prior to laying. Provide water temperature above 70°F when units are above 32°F. Water temperature shall be above 120°F when temperature of units are below 32°F.
- 3. Air Temperature 40°F to 32°F: Heat sand or mixing water to minimum of 70°F and maximum of 160°F.
- 4. Air Temperature 32°F to 25°F: Heat sand and mixing water to minimum of 70°F and maximum of 160°F.
- 5. Air Temperature 25°F to 20°F: Heat sand and mixing water to minimum of 70°F and maximum of 160°F. Provide heat on both sides of wall under construction. Employ wind breakers when wind is in excess of 15 mph.
- 6. Air Temperature 20°F and Below: Heat sand and mixing water to minimum of 70°F and maximum of 160°F. Provide enclosure and auxiliary heat to maintain air temperature above 32°F. Temperature of masonry units when laid shall not

be less than 20°F.

- E. Hot Weather Unit Masonry Construction Work: Protect unit masonry construction Work by methods acceptable to ENGINEER, from direct exposure to wind and sun when the surrounding air temperature is 99°F in the shade with relative humidity less than 50 percent.

PART 2 PRODUCTS

2.1 MATERIALS

- a. Refer to the following Sections for required masonry materials.
 - 1. Section 04100, Mortar.
 - 2. Section 04150, Masonry Accessories.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine areas and conditions under which unit masonry construction Work is to be installed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Wetting of Masonry Units:
 - 1. Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid.
 - 2. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.
- B. Cleaning Reinforcement: Before being placed, remove all loose rust, mill scale, earth, ice and other contamination from reinforcement. Do not use reinforcing bars with kinks or bends not shown on Drawings or approved Shop Drawings, or bars with reduced cross-section due to excessive rusting or other causes.

3.3 INSTALLATION, GENERAL

- A. Thickness: Build walls, floors and other unit masonry construction Work to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown or required by others. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete unit masonry construction Work to match Work immediately adjacent to openings.
- D. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.

3.4 LAYING MASONRY WALLS

A. General:

- 1. Mortar Types: Unless otherwise indicated, use mortar as specified in Section 4A, Mortar, and as follows:
 - a. For all wythes of exterior wall construction Work use Type S mortar.
 - b. For interior wall construction Work, use Type N mortar.
 - c. Use grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction Work.
 - d. Do not use mortar which has begun to set or if more than 1/2 hour has elapsed since initial mixing. Retemper mortar during the 1/2-hour period only as required to restore workability.
- 2. Layout walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.

3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
4. Pattern Bond:
 - a. Lay all concrete unit masonry construction Work in a running bond pattern with vertical joints centered on units in courses above and below.
 - b. Bond and interlock each course of each wythe at corners.
 - c. Do not use units with less than 8-inch horizontal face dimensions at corners or jambs.
5. Color and Texture:
 - a. Lay all concrete unit masonry construction Work using colored or white portland cement mortar.

B. Mortar Bedding and Jointing:

1. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
2. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
3. Maintain joint widths shown except for minor variations required to maintain pattern bond alignment. If not shown lay concrete unit masonry walls with 3/8-inch joint.
4. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, except paint, unless otherwise shown.
5. Tool exposed joints, when mortar is "thumbprint" hard, slightly concave. Rake out mortar in preparation for application of calking or sealants where required.
6. Concave-tool exterior joints below grade.
7. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position.

If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

- C. Collar Joints: Fill the vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging, for the following unit masonry construction Work:
 - 1. All multi-wythe concrete unit masonry and unfilled ground face concrete unit masonry walls.
- D. Stopping and Resuming Work: Rake back one unit masonry length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.
- E. Built-in Work:
 - 1. As the Work progresses, build in items shown, specified or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Fill cores in one block width solidly with masonry around built-in items.
 - 2. Fill space between hollow metal frames and masonry solidly with mortar.
 - 3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of cavity fill mesh in the joint below and rod mortar or grout into core.
 - 4. Where required by governing code requirements and to meet thickness to height ratio and to provide required fire-resistance, fill all cells of unit masonry construction solid with grout.
- F. Structural Bonding of Multi-Wythe Masonry:
 - 1. Use continuous reinforcing embedded in horizontal mortar joints for bond tie between wythes as specified herein.
 - 2. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.
 - a. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units as specified herein, in addition to masonry bonding.
 - 3. Intersecting and Abutting Walls: Unless vertical expansion or masonry control joints are shown at juncture, provide same type of bonding specified for structural

bonding between wythes and space as follows:

- a. Provide masonry bond in alternate courses.
- b. Provide individual metal ties at not more than 24 inches on centers vertically, unless shown at closer spacing.
- c. Provide continuity with horizontal joint reinforcing using prefabricated "T" and "L" units.

G. Non-Load-Bearing Partitions Wythes:

1. Build full height of story to underside of structure above, unless otherwise shown.
2. Tie non-load-bearing partitions at top and sides with masonry anchors at terminations. Build in end blocks to facilitate placing compressible filler. Insert compressible filler, specified in Section 4B, Masonry Accessories in all horizontal and vertical joints where non-load-bearing masonry terminates. Insert filler 3/4 inches from both faces of masonry. Use filler four times as thick as the widest part of the joint. Thickness of filler shall be a minimum of 1.5 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by 3 inches and compress ends to form tight joint. Finish with backer rod and sealant.

H. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 4B, Masonry Accessories, for type of reinforcing units required. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge masonry control joints and building expansion joints with reinforcing.
2. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, pipe enclosures and other special conditions.
4. Space continuous horizontal reinforcing as follows:

- a. For solid multi-wythe walls, where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16 inches on centers vertically.
 - b. For single wythe walls, space reinforcing at 16 inches on center vertically.
5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 24 inches beyond jambs of the opening.
 6. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.
- I. Structural Reinforced Unit Masonry Construction:
1. Shape and dimension reinforcement as shown and are required by governing codes.
 2. Position reinforcing accurately at the spacing shown. Support and secure vertical bars against displacement.
 3. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.
 4. For columns, piers and pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties.
 5. Provide lapped splices with reinforcing steel placed in contact and wire tied. Provide minimum lap required by governing code unless more stringent requirements are shown. Do not splice reinforcement at points other than shown or as approved on Shop Drawings.
- J. Grouting Structural Reinforced Unit Masonry Construction:
1. Limit extent of masonry construction to sections which do not exceed the maximum pour requirements specified. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.

2. Use fine grout for filling spaces less than 4 inches in both horizontal directions. Use coarse grout for filling spaces 4 inches or larger in both horizontal directions.
3. For spaces 10 inches and larger use concrete fill.
4. Low-Life Grouting:
 - a. Use low-lift grouting techniques using fine grout mix for the following:
 - 1) Two-wythe walls with grout space of 2-inches or less in width.
 - 2) Multi-wythe walls.
 - 3) At CONTRACTOR'S option, low-lift grouting technique may be used for structural reinforced unit masonry construction Work with grout spaces wider than 2 inches, except use coarse grout mix and place in lifts not to exceed 8 inches in height.
 - b. Grout spaces less than 2 inches in width at intervals not to exceed 24 inches in lifts of 6 to 8 inches.
 - c. Construct low-lift structural reinforced unit masonry construction Work by placing reinforcing, laying masonry units and pouring grout as the Work progresses.
 - d. Place vertical reinforcing bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcing bars may be placed progressively with laying of masonry units.
 - e. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 12 inch pour height.
 - f. Lay masonry units prior to each grout pour, but do not construct more than 12 inches above maximum grout pour height in one exterior wythe and 4 inches above in other exterior wythe. Provide metal wall ties if required to prevent blowouts.
 - g. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1-1/2 inches below top of highest course in pour.

K. Anchoring Masonry Work:

1. Provide anchoring devices of the type shown and as specified under Section 4B, Masonry Accessories. If not shown or specified, provide standard type for facing and back-up involved.
2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
 - a. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
 - b. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.
 - c. Space anchors as shown, but not more than 24 inches on center vertically and 36 inches on center horizontally.
 - d. Provide end blocks where masonry abuts structural support to facilitate installation of compressible filler, fire safing insulation, backer rod and sealant.
3. Anchor single wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Anchor veneer to concrete back up with dovetail anchors.

L. Masonry Control Joints:

1. Provide vertical control joints in masonry where shown. Build in related items as the unit masonry construction Work progresses. Rake out mortar in preparation for application of calking and sealants. Refer to Section 7J1, Calking and Sealants.
2. Provide masonry control joints consisting of items specified under Section 4B, Masonry Accessories, where masonry control joints are shown.

- a. Build in compressible fillers where shown. Install in accordance with manufacturer's written instructions.
 - b. Build in factory premolded control joint strips into masonry. Build in sash block and premolded control joint strips as the Work progresses.
 - c. Provide end blocks where masonry partitions abut structure to facilitate installation of compressible filler, fire safing insulation, backer rod and sealant.
3. Masonry Control Joint Spacing: Locate masonry control joints as shown.

M. Lintels and Bond Beams:

1. Provide steel lintels where shown and as specified in Section 5E3, Miscellaneous Metal Fabrications.
2. Provide masonry lintels and bond beams where shown and wherever openings of 16 inches or more are shown without structural steel lintels. Provide formed in place masonry lintels and bond beams. Temporarily support formed-in-place lintels and bond beams.
 - a. Unless otherwise shown, provide one horizontal number six deformed reinforcing bar for each 4 inches of wall thickness.
 - b. For hollow masonry unit walls, use specially formed "U" shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout as specified in Section 4A, Mortar.
3. Provide minimum bearing at each jamb, of 4 inches for openings less than 6 feet-0 inches wide, and 8 inches for wider openings.
4. On concrete unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain joint pattern of wall and install so as to be indistinguishable from surrounding masonry.

N. Flashing of Masonry Work:

1. Provide concealed flashings in masonry Work as shown. Refer to Section 7H1, Flashing and Trim. Prepare masonry surfaces smooth and free from projections which might puncture flashing. Place through wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 inch from face of wall, unless otherwise shown.

3.5 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide anew units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing Concrete Unit Masonry: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 - 1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's work.
 - 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain ENGINEER'S acceptance of sample cleaning before proceeding to clean remainder of masonry work.
 - a. Dry clean to remove large particles of mortar using wood paddles and scrapers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Comply with the requirements and recommendations for "Cleaning Clay Products Masonry" of the Technical Notes on Brick and Tile Construction by Brick Institute of America for the type of masonry and conditions involved in the Work.
 - d. Apply acid type cleaners in compliance with manufacturer's instructions.
 - e. Protect other Work from acid solutions and cleaning operations.
- D. Protection:
 - 1. Protect the unit masonry construction Work from deterioration, discoloration or damage during subsequent construction operations. See Section 06100, Rough Carpentry.

END OF SECTION 04200

SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, and incidentals required to provide structural steel, including surface preparation and shop priming.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

- 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
- 2. AISC Specifications for Structural Steel Buildings including Commentary".
- 3. AWS D1.1, Structural Welding Code.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for approval Shop Drawings including complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures and diagrams showing the sequence of erection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rolled Steel Plates, Shapes and Bars: ASTM A 36, except where other type steel is shown.
- B. Cold-Formed steel Tubing: ASTM A 500, Grade B.
- C. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- D. Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490; unfinished bolts and nuts, ASTM A 307, Grade A.

- E. Electrodes for Welding: E70XX complying with AWS D1.1, Design of New Buildings, Section 8.
- F. Shop Paint: Included herein but as specified in Section 9L.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. General:

- a. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC, Manual of Steel Construction, and as shown on the Shop Drawings.
- b. Provisions for Other Work: Fabricate structural steel members to provide holes for securing other work and for passage of other work through steel framing as indicated.

B. Connections:

1. Shop Connections:

- a. Unless otherwise shown, shop connections may be welded or high strength bolted. Unless shown otherwise, all welds shall be 1/4-inch minimum.
- b. Wherever reaction values of a beam are not shown, the connections shall be designed to support the total uniform load capacity tabulated in the AISC tables for allowable loads on beams for the given shape, span, and steel specified for the beam in question.

2. Field Connections:

- a. All field connections unless otherwise specified below or noted shall be made with high strength bolts, and shall be bearing type connections.

C. Columns: Columns shall have milled bearing surfaces at the base and at all splice lines.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his erector shall examine areas and conditions under which structural steel Work is to be installed, and notify ENGINEER of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Anchor Bolts:
 - 1. Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work.
 - 2. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
- C. Setting Bases and Bearing Plates:
 - 1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 2. Set loose and attached base plates and bearing plates for structural members on steel wedges and grout.
- D. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Level and plumb individual members of the structure within tolerances as specified in AISC Manual.
- E. Touch-Up Painting:
 - 1. Comply with all requirements of touch-up painting in Section 9L.

END OF SECTION 05120

SECTION 05500
MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install all miscellaneous metal fabrications Work, including items fabricated from iron, steel and aluminum shapes, plates, bars, castings and extrusions, which are not a part of other metal systems covered by other Sections of these Specifications.
- B. The types of miscellaneous metal fabrications Work required includes, but not limited to, the following:
 - a. Ladders.
 - b. Ladder safety cages.
 - c. Fall prevention system.
 - d. Expansion shield fasteners.
 - e. Miscellaneous framing and supports.
 - f. Truck bollards.
 - g. Miscellaneous accessories and fasteners.

1.2 RELATED SECTIONS

- A. Section 03300, Concrete.
- B. Section 09900, Painting.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A 36, Structural Steel.

2. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
 3. ASTM A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 4. ASTM A 240, Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels.
 5. ASTM A 320, Alloy Steel Bolting Material for Low Temperature Service.
 6. ASTM A 386, Zinc Coating (Hot-Dip) on Assembled Steel Products.
 7. ASTM B 209, Aluminum-Alloy Sheet and Plate.
 8. ASTM B 211, Aluminum-Alloy Bars, Rods and Wire.
 9. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 10. ANSI A14.3, Safety Requirements for Fixed Ladders.
 11. AWS D1.1, Structural Welding Code.
 12. AISI Standards for Stainless Steel.
- B. Design Criteria: The size and spacing of expansion bolts, anchor bolts, cast-in-place inserts and similar items shown or specified shall be considered the minimum acceptable size. Final selection of these items shall be based upon the actual design load times a minimum safety factor of four. Where the size and spacing of expansion bolts, anchor bolts, cast-in-place inserts and similar items are not shown or are not specified, the CONTRACTOR shall provide such items of sufficient size, length, load carrying capacity and spacing required to carry the design load times a minimum safety factor of four. Provide non-corrodible materials for all such items.
- C. Field Measurements: Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- D. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.4 SUBMITTALS

- A. Submit for approval sets of representative samples of materials including nosings, rungs and other finished products as requested by the ENGINEER. Review will be for color, texture, style, and finish only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.
- B. Submit for approval the following:
 - 1. Shop Drawings for the fabrication and erection of all assemblies of miscellaneous metal fabrications Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for location and installation of miscellaneous metal fabrications items and anchorage devices.
 - 2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal fabrications Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Stainless Steel Sheet and Plate: ASTM A 240.
- B. Steel Plates, Shapes and Bars: ASTM A 36.
- C. Aluminum:
 - 1. Alloy and Temper: Provide alloy and temper as shown or specified, or as otherwise recommended by the aluminum producer or finisher.
 - 2. Extruded Shapes and Tubes: ASTM B 221.
 - 3. Plate and Sheet: ASTM B 209.
 - 4. Bars, Rods and Wire: ASTM B 211.
 - 5. Finish: Provide Architectural Class I anodized finish AA-M32C22A41 Clear as specified in the NAAMM Manual.
- D. Stainless Steel Fasteners and Fittings: ASTM A 320.
- E. Zinc Coated Hardware: ASTM A 153.

2.2 MISCELLANEOUS METAL ITEMS

A. Aluminum Ladders:

1. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as shown and specified. Comply with the requirements of ANSI A14.3, except as otherwise shown or specified.
 - a. Unless otherwise shown, provide aluminum pipe, ASTM B 429, 554, 1.90-inch outside diameter, Schedule 80 side rails spaced 18 inches apart, minimum.
 - b. Provide solid aluminum square rungs, spaced 12 inches on centers, maximum, with non-slip surface on the top of each rung.
2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
3. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on centers. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7 inches clearance from wall to centerline of rungs. Extend rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.

B. Aluminum Ladder Safety Cages:

1. Fabricate ladder safety cages from flat bars, assembled by welding. Unless otherwise shown, provide 1/2-inch by 3-inch top, bottom and intermediate hoops spaced not more than 5 feet on centers; and 3/8-inch by 2-inch vertical bars, secured to each hoop. Space vertical bars approximately 9 inches on centers. Fasten assembled safety cage to ladder rails and adjacent construction as shown. Grind all welds, sharp edges and projections smooth.
2. Comply with the requirements of ANSI A14.3.

C. Fall Prevention System: All ladders shall be provided with a fall prevention system. The system shall meet OSHA standards.

1. The system shall consist of curved and straight custom lengths of Type 316 stainless steel notched carrier rails and rung clamps permanently attached to

the ladder to which a harness belt is attached. Spacing of ladder attachments shall be provided as recommended by the manufacturer.

2. Provide each ladder with one of each of the following in addition to rail and support assemblies:
 - a. Cast manganese bronze locking sleeve with locking pawl filled with fire stainless steel sealed roller bearings in covered housing.
 - b. Polyester nylon and leather safety belt recommended by the system manufacturer for full feature compatibility.
 - c. Removable stainless steel extension system consisting of rail, stainless steel tie-down rod and mandril.
3. System manufacturer shall review each ladder to determine desirability of detachment sections. Inform Engineer of recommendations.
4. Product and Manufacturer: Provide fall prevention systems as manufactured by one of the following:
 - a. Saf-T-Climb System by North Consumer Products, A division of Siebe North Incorporated.
 - b. Or equal.

Loose Steel Lintels: Provide loose hot dipped galvanized structural steel lintels for openings and recesses in masonry walls and partitions as shown. Where not shown provide loose steel lintels as specified. Weld adjoining members together to form a single unit and grind welds smooth where exposed in the finished Work. Provide not less than 4 inches bearing at each side of openings, unless otherwise specified. Unless otherwise shown size loose lintels as follows:

Clear Span
(Max)

Exterior Angle

Interior Angles

-0"	3-1/2-inches x 3-1/2-inches x 5/16-inches	(2) 3-1/2-inches x 3-1/2-inches x 5/16-inches
6'-0"	4-inches x 3-1/2-inches x 5/16-inches	(2) 4-inches x 3-1/2-inches x 5/16-inches
8'-0"	5-inches x 3-1/2-inches x 5/16-inches	(2) 5-inches x 3-1/2-inches x 5/16-inches
Greater than 8'-0"	Submit calculations prepared, signed and stamped with the seal of a greater than 8'-0" Registered Professional Engineer licensed to practice in the State of Rhode Island and recognized as an expert in the required Work.	

- E. Shelf Angles: Provide galvanized steel shelf angles of sizes shown for attachment to concrete and masonry construction. Provide horizontal slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 2 foot-6 inches on centers. Weld adjoining members together to form a single unit and grind welds smooth where exposed in the finished Work.
- F. Miscellaneous Framing and Supports:
1. Provide miscellaneous metal framing, supports and other metal items required which are not a part of the structural steel framework and are required to complete the Work.
 2. Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates, tanks, doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.
 3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

- a. Except as otherwise shown, space anchors, 24 inches on centers, and provide units and equivalent of 1-1/4-inch by 1-1/4-inch by 8-inch strips.
- b. Galvanize all exterior miscellaneous framing and supports.
- c. Galvanize interior miscellaneous framing and supports where shown.

G. Alternating tread cross-over ladder and platform:

- 1. Provide stair 24-inches wide and platform 24-inches square fabricated from AAF356F cast alloy aluminum with all walking surfaces cast with skid resistant patterns as follows:
 - a. Provide stairs 68 degrees to horizontal.
 - b. Fabricate to clear containment wall.
 - c. All castings MIG welded.
 - d. Provide cast aluminum foot divider integral with platforms.
 - e. Railings shall be contoured for body guidance and underarm support and be fabricated of 6061-T4 aluminum.
 - f. Central stringer shall be aluminum 6063-T52.
 - g. All aluminum shall be A41 clear anodized.
- 2. Product and Manufacturer: Provide one of the following:
 - a. Alternating tread cross-over aluminum ladder and associated platforms by Lapeyre Stair Incorporated.

- H. Truck Bollards: Provide 8-inch diameter, double extra strong galvanized steel pipe, 3 foot-4 inches above grade, 3 feet below grade. Fill with concrete and mound top.
- I. Primer Paint: Unless otherwise shown or specified, prepare surfaces and prime steel items as required under Section 09900, Painting.
- J. Galvanizing: All galvanizing of fabricated steel items shall comply with the requirements of ASTM A 123.

- K. Aluminum Finish: Provide a natural mill finish for all aluminum Work unless otherwise shown or specified.
- L. Expansion Shield Fasteners: Unless otherwise specified by materials or equipment manufacturer, expansion anchors shall conform to the following:
 - 1. For items not anchored into concrete or masonry with integral anchors welded or bolted to the item, provide fasteners for anchoring made of stainless steel as specified.
 - 2. Install fastener in accordance with manufacturer's recommendations.
 - 3. 1/2-inch diameter, 2-inches embedment length minimum.
 - 4. Power driven pin" and stud" type fasteners will not be permitted.
 - 5. Product and Manufacturer: Provide one of the following:
 - a. Molly Parabolts by USM Corporation.
 - b. Kwik-Bolt by Hilti Corporation.

2.3 SURFACE PREPARATION AND SHOP PAINTING

- A. Surface preparation and shop painting is required for all ferrous metals, equipment and accessories. Stainless steel shall not be painted.
- B. All ferrous metal surfaces shall be cleaned and provided with surface preparation and two coats of priming paint in accordance with the applicable requirements of Section 09900, Painting. All prime coat materials shall be compatible with the finish coat materials to be furnished under Section 9L, Painting.

PART 3 EXECUTION

3.1 FABRICATION, GENERAL

- A. Use materials of the size and thicknesses shown. If not shown, use the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on Shop Drawings using proven details of fabrication and support. Use the type of materials shown or specified for the various components of Work.

- B. Form exposed Work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown or specified. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
- C. Weld corners and seams continuously and in accordance with the recommendation of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces. Discoloration of finished surfaces of materials not to be painted will not be acceptable.
- D. Form exposed connections with hairline joints which are flush and smooth using concealed fasteners wherever possible. Use exposed fasteners of the type shown or if not shown, use flathead (countersunk) screws or bolts.
- E. Cut, reinforce, drill, and tap miscellaneous metal fabrications Work as may be required to receive finish hardware and similar items of Work.
- F. Use hot-rolled steel bars for Work fabricated from bar stock unless Work is otherwise shown or specified to be fabricated from cold-finished or cold-rolled stock.

3.2 INSTALLATION

- A. Set miscellaneous metal fabrications accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible. Comply with the following:
 - 1. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
 - 2. Assure that embedded items are protected from damage and are not filled in with concrete.
 - 3. Expansion anchors may be used for hanging or supporting 2-inch diameter pipes and smaller. Expansion anchors shall not be used for larger pipe unless otherwise shown or approved by ENGINEER. 4. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
 - a. Minimum embedment depth in concrete: 5 diameters.
 - b. Minimum anchor spacing on centers: 10 diameters.

- c. Minimum distance to edge of concrete: 5 diameters.
 - d. Increase dimensions above if required to develop the required anchor load capacity.
- C. Fit exposed connections accurately together to form tight hairline joints. Weld steel connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind steel joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. Protection of Aluminum from Dissimilar Materials: Using approved washers, strips or sheets of felt, and coating specified in Section 09900, Painting, protect all surfaces of aluminum from contact with dissimilar materials such as concrete, masonry, steel, nonferrous metals, etc.

END OF SECTION 05500

SECTION 05505
ANCHOR BOLTS, EXPANSION ANCHORS AND CONCRETE INSERTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install anchor bolts, expansion anchors and concrete inserts.
- B. This Section includes all bolts, anchors, toggles and inserts required for the Work but not specified under other Sections.
- C. The types of work using the bolts, anchors, toggles and inserts include, but are not limited to the following:
 - 1. Hangers and brackets.
 - 2. Equipment.
 - 3. Piping.
 - 4. Tanks.
 - 5. Grating and floor plate.
 - 6. Electrical, Plumbing and HVAC Work.
 - 7. Wood and plastic fabrications.
 - 8. Partitions.
 - 9. Shelf angles and masonry lintels.

1.2 RELATED SECTIONS

- 1. Section 05120, Structural Steel.
- 2. Section 05500, Miscellaneous Metal Fabrications.
- 3. Section 05520, Aluminum Handrails and Railings.

4. Section 15140, Pipe Hangers, Supports and Restraints.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
 - 1. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - 2. ASTM A 320, Specification for Alloys-Steel Bolting Materials for Low-Temperature Service.
- B. Expansion anchors and inserts shall be UL or FM approved.
- C. Toggle Bolts: FS-FF-B-588C, Type I, Class A, Style 1.

1.4 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Setting drawings and templates for location and installation of anchorage devices.
 - 2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.
- B. Samples: Submit for approval the following:
 - 1. Representative samples of bolts, anchors and inserts as may be requested by ENGINEER. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.

B. Determine design loads as follows:

1. For equipment anchors, use the design load recommended by the manufacturer and approved by ENGINEER.
2. For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
3. Allowances for vibration are included in the safety factor specified above.
4. Anchors shall develop ultimate shear and pull-out loads of not less than the following values in concrete:

<u>Bolt Diameter</u> <u>(Inches)</u>	<u>Min. Shear</u> <u>(Pounds)</u>	<u>Min. Pull-Out Load</u> <u>(Pounds)</u>
1/2	4,500	6,300
5/8	6,900	7,700
3/4	10,500	9,900

2.2 MATERIALS

A. Anchor Bolts:

1. Provide carbon steel bolts complying with ASTM A 307, non headed type unless otherwise indicated.
2. In buried or submerged locations, provide stainless steel bolts complete with nuts and washers complying with ASTM A 320, AISI Type 304. Other AISI types may be used subject to ENGINEER'S approval.

B. Expansion Anchors:

1. Provide stainless steel anchors complying with ASTM A 320, AISI Type 304.
2. Anchors shall be of the size required for the concrete strength specified. Provide stud type (male thread) or flush type (female thread), as required.
3. Manufacturer: Provide anchors of one of the following:
 - a. Molly Division of USM Corporation.
 - b. Hilti, Incorporated.

4. In buried or submerged locations, provide stainless steel anchors complying with ASTM A 320, AISI Type 303. Other AISI types may be used, subject to ENGINEER'S approval.
- C. Toggle Bolts:
1. Provide spring-wing toggle bolts, with two-piece wings.
 2. Provide carbon steel bolts with zinc coating in accordance with FS-QQ-Z-325.
 3. Manufacturer: Provide toggle bolts of one of the following:
 - a. U.S.E. Diamond, Incorporated.
 - b. Haydon Bolts, Incorporated.
- D. Concrete Inserts:
1. For piping, grating, floor plate and masonry lintels, provide malleable iron inserts. Provide those recommended by the manufacturer for the required loading.
 2. Finish shall be black.
 3. Product and Manufacturer: Provide one of the following inserts:
 - a. Figure 282 by ITT Grinnell.
 - b. No. 380 by Hohmann and Barnard, Incorporated.
- E. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by ENGINEER.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine areas and conditions under which anchor bolts, expansion anchors, toggle bolts and concrete insert Work is to be installed, and notify ENGINEER of conditions detrimental to proper and timely completion of Work.

3.2 INSTALLATION

- A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- B. Assure that embedded items are protected from damage and are not filled in with concrete.
- C. Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller. Expansion anchors shall not be used for larger pipe unless otherwise shown or approved by ENGINEER.
- D. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
- E. Use toggle bolts for fastening brackets and other elements onto masonry units.
- F. Unless otherwise shown or approved by ENGINEER conform to following for expansion anchors:
 - 1. Minimum embedment depth in concrete: 5 diameters.
 - 2. Minimum anchor spacing on centers: 10 diameters.
 - 3. Minimum distance to edge of concrete: 5 diameters.
 - 4. Increase dimensions above if required to develop the required anchor load capacity.

3.3 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

END OF SECTION 05505

SECTION 05520
ALUMINUM HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install aluminum handrail and railings Work including, but not necessarily limited to top and intermediate horizontal railing, handrail, toeboard, anchors and fasteners, sleeves, castings, reinforcing inserts, wall brackets, and other miscellaneous accessories.

1.2 RELATED SECTIONS:

- 1. Section 03010, Grout.
- 2. Section 05500, Miscellaneous Metal Fabrications.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

- 1. Engage a single firm, with undivided responsibility for performance of the aluminum handrail and railing Work.
- 2. Engage a firm which can show five (5) years previous successful experience in the fabrication and erection of aluminum handrail and railing systems of scope and type similar to the required Work.
- 3. Provide manufacturer capable of fabricating custom details shown.

B. Design Criteria:

- 1. Provide adequate expansion within the fabricated system which allows a thermal change of 100° F above installation temperature without warp or bow. Provide 0.1 inch space for each 20 feet of length of rail for each 25° F difference of thermal change specified or use manufacturer's published formulas for determining expansion joint movement and spacing. Limit the exposed width of each expansion joint to 1/4 inch.
- 2. Provide expansion joint in aluminum handrail and railing system work where systems cross expansion joints in structure.

3. Aluminum handrail and railing is shown to indicate general locations where handrail and railing is required by the ENGINEER. All aluminum handrail and railing shown shall be as specified herein regardless of the number of immediate horizontal rails shown. In addition, where handrail or railing is required by either the State of Rhode Island Official Compilation of Codes, Rules and Regulations or the Occupational Safety and Health Act of 1970, aluminum handrail and railing of the type specified herein shall be provided at no additional cost to ENGINEER, whether or not shown.
4. Configuration of all handrail and railing details shall be as shown on the General Railing and Handrail Sheet regardless of symbolic indications which may be otherwise shown.
5. Provide aluminum handrail and railing system Work that conforms to OSHA, Part 1910.23, including the 200 pound loading requirement. In addition, the system shall conform to the following requirements of ANSI A1264:
 - a. Completed aluminum handrail and railing system Work to withstand a load of 25 pounds per linear foot applied in any direction at the top of the handrail and railing.
 - b. Intermediate rail to withstand a horizontal load of 20 pounds per linear foot.
 - c. All above loads are not additive.
 - d. Other pertinent requirements ceded to ANSI A1264.1 by governing codes.
6. Select systems components and post spacing so that specified applied loads produce no permanent set in the completed aluminum handrail and railing system Work.
7. All railing system posts shall be provided with a circular profile solid reinforcing bar with outside diameter equal to inside diameter of post. All posts shall receive one reinforcing bar. Select schedule of pipe using alloys, minimum diameter, loadings and maximum post spacing specified in order to limit deflection in each single-span of handrail and railing to 1.5-inches maximum and on railing posts to 1.4-inches maximum and with a safety factor of 1.65:1 for all Work.

C. Codes: Comply with the applicable requirements of the State of Rhode Island Official Compilation of Codes, Rules and Regulations and the Occupational Safety

and Health Act of 1970 for types of aluminum handrail and railing system Work shown and specified.

D. Allowable Tolerances:

1. Limit variation of cast-in-place inserts, sleeves and field drilled holes to the following:
 - a. Spacing: $+3/8$ inch.
 - b. Alignment: $+1/4$ inch.
 - c. Plumbness: $+1/8$ inch.
2. Limit variation of completed railing system alignment to $1/4$ inch in 12 feet.
3. Set rails horizontal or parallel to rake of steps or ramp to within $1/4$ inch in 12 feet.

E. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM B 26, Aluminum-Alloy Sand Castings.
2. ASTM B 210, Aluminum-Alloy Drawn Seamless Tubes.
3. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. ASTM B 241, Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
5. ASTM B 247, Aluminum-Alloy Die and Hand Forgings.
6. ASTM B 429, Aluminum-Alloy Extruded Structural Pipe and Tube.
7. AWS D10.7, Gas Shielded-Arc Welding of Aluminum and Aluminum Alloy Pipe.
8. The Aluminum Association, Aluminum Standards and Data; and Standards for Anodized Architectural Aluminum.
9. NMMM, Metal Finishes Manual".

10. NMMM, Pipe Railing Manual.
11. ANSI A1264.1, Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems.
12. OSHA Part 1910.23 - Guarding Floor and Wall Openings and Holes.

- F. Field Measurements: Take field measurements, where required, prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- G. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

1.4 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. Full size sample of assembled post and rails intersections with all associated components including mounted toeboard and socket, all with specified metal finish, including typical welded or bolted connections, with rails not less than 6-inches long. Samples will be reviewed for finish, color, joinery tolerances, workmanship and general component assembly only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
 2. Color Samples: Maximum range of clear anodized aluminum that shall appear in finished Work. Prepare range samples, to show the highest level of color control feasible for actual aluminum handrail and railing system Work, as determined by the licensor of the finishing process selected, on actual extrusions and castings of the Work.
- B. Shop Drawings: Submit for approval the following:
 1. Shop Drawings for the fabrication and erection of aluminum handrail and railing system Work. Include all plans and elevations identifying the location of all handrail and railing, and details of sections and connections. Show all anchorage items.
 2. Calculations for the complete structural design of the aluminum handrail and railing system Work including calculations showing compliance with design criteria specified.

3. Manufacturer's complete catalogs showing complete selection of standard and custom components and miscellaneous accessories for selection by the ENGINEER.
4. Maintenance Manuals: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning, including cleaning materials, application methods and precautions as to use of materials that may be detrimental to finish when improperly applied.
- C. Certification: Furnish certification by manufacturer that load tests have been performed on the aluminum handrail and railing systems Work and that they conform to all applicable OSHA, ANSI and building code requirements for loading and deflections and meet minimum criteria specified herein.
- D. Finish: Furnish a written certificate confirming specified coating film thickness, coating weight, sealing treatment and stain test.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver materials to the site in good condition and properly protected against damage to finished surfaces.
- B. Storage of Materials:
 1. Store all materials in clean, dry location, away from uncured concrete and masonry.
 2. Cover all materials with waterproof paper, tarpaulin or polyethylene sheeting.
- C. Handling of Materials:
 1. Keep on-site handling to a minimum.
 2. Maintain protective covering on handrails and railings until installation is complete.

1.6 JOB CONDITIONS

- A. Protection: Protect cast-in-place sleeves and field-drilled holes from debris and water intrusion by use of temporary covers or removable foam inserts.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Extruded Aluminum Architectural and Ornamental Shapes: ASTM B 221, Alloy 6063-T52.
- B. Aluminum Forgings: ASTM B 247.
- C. Extruded or Drawn Aluminum Pipe and Tube:
 - 1. ASTM B 429 or ASTM B 241, Alloy 6063-T5, 6063-T52 or 6063-T832 as required by loadings, deflections and post spacings specified.
 - 2. Provide all rails and posts with minimum outside diameter of 1.900-inches.
- D. Reinforcing Bars: Solid 24-inch long 6061-T6 circular cross section aluminum reinforcing bars with outside diameter same as inside diameter of post.
- F. Anchors and Fastenings: Stainless steel of the type recommended by the manufacturer of the aluminum handrail and railing system. Provide minimum of four bolt fasteners per post where surface mounted posts are shown.
- G. Castings:
 - 1. Provide high strength aluminum alloy brackets, flanges and fittings suitable for anodizing as specified.
 - 2. Aluminum-Alloy Sand Castings: ASTM B 26.
- H. Connector Sleeves: Schedule 40, 5-inches long by 1.610-inches diameter.
- I. Brackets and Flanges: Provide manufacturer's complete selection of standard and custom brackets and flanges for railing posts and for handrail supports.
- J. Sockets: Provide 6-inch deep by 2-1/2-inch outside diameter aluminum sockets with 3-1/2-inch wide socket cover on bottom of all sockets and on top and bottom of removable post sockets.

- K. Hinges: Provide two self-closing aluminum hinges for each railing system gate shown.
- L. Latches and Stops: Provide one latch and stop with rubber bumper and 1-inch diameter plastic knob for each railing system gate shown.
- M. Chain, Snaps and Eye Bolts: Provide oblong 0.250-inch welded link, Type 316 stainless steel chain weighing 57 pounds per cubic foot, each link 1-1/8-inch by 7/16-inch. Provide stainless steel eyebolts, 1/4-inch stainless steel threaded quick links and heavy duty swivel snaps with spring loaded latch.
- N. Cover Flanges: Provide 1-inch high by 4-inch diameter aluminum cover flanges for all non-removal posts and 3-1/2-inch wide by 1-1/8-inch high aluminum pipe collars with 1/4-inch set screws for all removable posts.
- O. Components and Miscellaneous Accessories: Provide a complete selection of manufacturer's standard and custom aluminum handrail and railing components and miscellaneous accessories.
- P. Adhesive: Epoxy type as recommended by handrail and railing manufacturer.

2.2 FABRICATION

- A. Form exposed Work true to line and level with accurate angles, surfaces and straight edges.
- B. Form bent-metal corners to the radius shown without causing grain separation or otherwise impairing the Work. Form all change in handrail and railing direction with radius bends.
- C. Remove burrs from all exposed edges.
- D. Form elbow bends and wall returns to uniform radius, free from buckles and twists, with smooth finished surfaces, or use prefabricated bends.
- E. Locate intermediate rail equally spaced between top rail and finished floor.
- F. Close aluminum pipe ends by using prefabricated fittings.
- G. Weep Holes:
 - 1. Fabricate joints which will be exposed to the weather so as to exclude water.

2. Provide 15/64 inch diameter weep holes at the lowest possible point on all railing system posts.
 3. Provide pressure relief holes at closed ends of handrails and railings.
- H. Toeboards:
1. Provide extruded 6063 alloy aluminum toeboards for railings, unless railing is mounted on curbs or other construction of sufficient height and type to meet the requirements of OSHA 1910.23. Bars or plates are not acceptable and shall not be approved by ENGINEER.
 2. Unless otherwise specified, toeboards shall meet requirements of OSHA Part 1910.23, Section (e).
 3. Provide manufacturer's toeboard detail which accommodates movement caused by thermal change specified without warping or bowing toeboards.
- I. Reinforcing Bars: Provide circular profile solid reinforcing bar friction-fitted at all railing system posts. Extend reinforcing bars 6-inches into cast-in-place sleeves or other types of supporting brackets.
- J. Mechanically Fitted Component Pipe Handrail and Railing:
1. Use a nonwelded pipe handrail and railing system with posts, top and intermediate rail(s) and flush joints.
 2. Provide a top and one intermediate horizontal rail, equally spaced.
 3. Blind rivets, pop rivets or other exposed fastening devices shall not be used in the Work. Fasteners used for side mounting fascia flanges where shown or specified may be exposed in the Work. Provide internal threaded tubular aluminum rivets, stainless steel through bolts with lock nuts, stainless steel sheet metal screws with lockwashers and epoxy adhesive for fastening all components of the Work.
 4. Product and Manufacturer: Provide one of the following:
 - a. Custom Fabricated Connectorail System by Julius Blum & Company, Incorporated.
 - b. Custom Fabricated Series SOO Non-Welded Aluminum Pipe Railing by Superior Aluminum Products, Incorporated.

2.3 ALUMINUM COATINGS

A. General:

1. Prepare surfaces for finishing in accordance with recommendations of the aluminum producer and the finisher or processor.
2. Adjust and control the direction of mechanical finishes specified to achieve the best overall visual effect in the Work.
3. Color and Texture Tolerance: ENGINEER reserves the right to reject aluminum materials because of color or texture variations, which are visually objectionable, but only where the variation exceeds the range of variations established by the manufacturer prior to the Work, by means of range samples which have been accepted by ENGINEER.
4. Anodize all aluminum components of the Work.

B. Exposed Aluminum Anodic Coating: Provide anodic coatings as specified which do not depend on dyes or impregnation processes to obtain color. Apply architectural Class 1 coatings using only the alloy and electrolyte to obtain specified colors. Comply with the following:

1. Chemically finish aluminum by etching to a medium matte finish, Aluminum Association Designation - C22.
2. Desmut by bathing the aluminum in either nitric acid solution or as recommended by the coating applicator.
3. Clean and rinse between steps as recommended by the aluminum manufacturer.
4. Provide architectural Class I high density anodic coating, Aluminum Association Designation A41, for clear coatings.
5. Coating Thickness, ASTM B 244: Minimum of 0.7 mils thick.
6. Coating Weight, ASTM B 137: Minimum of 32 mg/sq. in.
7. Resistance to Staining, ASTM B 136: No stain after 5 minutes dye solution exposure.

8. Salt Spray, ASTM B 117: 30,000 hours exposure with no corrosion or shade change.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which the aluminum handrail and railing system Work is to be performed and notify the ENGINEER in writing of unsatisfactory tolerances which exceed specified limits and other conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 INSTALLATION

- A. Fastening to In-Place Construction:

1. Adjust aluminum handrail and railing system Work prior to securing in place, to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - a. Anchor posts in concrete by means of sockets and side mounted fascia flange brackets, set and anchored into the concrete floor slabs and sides of concrete walls and raised walkways. Provide closure secured to the bottom of sleeve. Before installing posts remove all debris and water from sleeves. Verify that reinforcing bars have been inserted into posts before installation. Do not install posts without reinforcing bar. For all nonremovable railing sections, after the posts have been inserted into the sockets, fill the annular space between posts and sockets solid with grout as specified in Section 03600, Grout.
 - b. Anchor posts to stair stringers with stringer or support flanges, angle type or floor type as required by conditions, shop connected to posts and bolted to the supporting members. Flanges shall be as recommended by manufacturer. Verify that reinforcing bars have been inserted into posts before installation. Do not install posts without reinforcing bar.
 - c. Provide removable railing sections where shown. Removable railing posts shall be provided with friction fitted reinforcing bar in each post. Provide sockets with socket covers stored in extruded toeboard. Provide

aluminum pipe collars for all removable posts. Accurately locate sleeves to match post spacings.

- d. All posts set in concrete shall be provided with an aluminum floor cover flange.
2. Use devices and fasteners recommended by the aluminum handrail and railing manufacturer.

B. Cutting, Fitting and Placement:

1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
2. Fit exposed connections accurately together to form tight hair- line joints. Do not cut or abrade the surfaces of units which have been finished after fabrication, and are intended for field connections.
3. Permanent field splice connections shall be made using manufacturer's recommended epoxy adhesive and 5-inch minimum length connector sleeves. Tight press-fit all field splice connectors and install in accordance with manufacturer's written instructions. Follow epoxy manufacturer's recommendations for requirements of installation and conditions of use.
4. Make all splices as near as possible to posts but not exceeding 12 inches from nearest post.
5. Space posts 6 foot-0 inch minimum on centers and 8 foot-0 inch maximum on centers, based on loading and deflection criteria specified and manufacturer's suggested maximum spacing except where details shown dimension required locations for posts. Where details show post location requirements at or near end of runs, uniformly space intermediate posts as required to meet loading and deflection criteria specified but not greater than maximum spacing specified.
6. Provide hinged railing sections as shown. Provide hinges and latch for connection to adjacent railing.
7. Provide chain sections as shown. Provide one chain length with fastening accessories for top and each intermediate railing.

8. Secure handrails to walls with wall brackets and end fittings as shown. Locate brackets as shown or, if not shown, at not more than 5 feet on centers.
9. Secure wall brackets to building construction as follows:
 - a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts having square heads.
10. Securely fasten toeboards in place with not more than 1/4 inch clearance above floor level.
11. Drill one 15/64 inch diameter weep hole not more than 1/4 inch above the top of location of circular profile solid reinforcing bar in each post.

C. Expansion Joints:

1. Provide slip joint with internal sleeve extending 2 inches minimum beyond joint on each side.
2. Construct expansion joints as for field splices except fasten internal sleeve securely to one side of rail only.
3. Locate joints within 6 inches of posts.
4. Submit locations and details of all expansion joints to the ENGINEER.

D. Protection from Dissimilar Materials:

1. Coat all surfaces of aluminum in contact with dissimilar materials such as concrete, masonry and steel as specified in Section 09900, Painting.
2. Remove coating where exposed in the finished Work.

3.3 CLEANING AND REPAIRING

- A. Remove protective plastic as recommended by manufacturer immediately after installation.
- B. Remove all stains, dirt, grease or other substances by washing railings thoroughly using clean water and soap; rinse with clean water.

- C. Do not use acid solution, steel wool or other harsh abrasives. If stain remains after washing remove defective sections and replace with new material meeting the requirements of the Specification.
- D. Remove all damaged or otherwise defective Work and replace with material that meets specification requirements.

END OF SECTION 05520

SECTION 05535
ALUMINUM GRATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide and install aluminum pressure-locked grating and frames.
- B. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the grating.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
 - 1. ASTM B 210, Standard Specification for Aluminum and Aluminum Alloy Drawn Seamless Tubes.
 - 2. ASTM B 221, Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 - 3. MMM, Metal Finishes Manual, and Metal Bar Grating Manual.
- B. Field Measurements:
 - 1. Take field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the Work.

1.3 SUBMITTALS

- A. Submit for approval the following: Representative samples of grating, appurtenances and other finished products as requested by ENGINEER. His review will be for type and finish only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.
- B. Submit for approval the following:
 - 1. Fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
 - 2. Setting drawings and templates for location and installation of anchorage devices.
 - 3. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

PART 2 PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. The manufacturer shall furnish grating to conform the following criteria:
 - 1. Design Loads: Uniform live load or a concentrated load on any area 24 inches square, whichever gives the greatest stresses.

<u>Live Load</u>	<u>Concentrated Load</u>
200 psf	2000 lbs
 - 2. Maximum Clear Span Deflection: 1/120 of span.
 - 3. Maximum Fiber Stress: 12,000 psi.

4. Bearing bars shall be a maximum of 1-3/16 inches on center and 3/16 inches minimum thickness.
5. Cross bars or bent connecting bars shall not exceed 7 inches on center.

2.2 MATERIALS

- A. Bearing Bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B 221.
- B. Cross Bars or Bent Connecting Bars: Alloy conforming to either ASTM B 221 or ASTM B 210.
- C. Rivets: Aluminum-Alloy as recommended by the Manufacturer.

2.3 FABRICATION

- A. Use materials of the minimum size and thickness as specified above unless shown otherwise. Work to the dimensions shown on approved Shop Drawings.
- B. Grating shall be as shown and shall comply with the NAAMM "Metal Bar Grating Manual", except as specified herein.
 1. Cross Bars: Perpendicular to bearing bars, secured by mechanical locking.
 2. Traffic Surface: Plain.
- C. Type of Finish: Mill, as fabricated.
- D. Provide grating sections with end-banding bars welded about 4 inches on centers for each panel, 4 saddle clip or flange block anchors designed to fit 2 bearing bars, and 4 stud or machine bolts with washers and nuts, unless otherwise indicated.

- E. Cut gratings for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating.
 - 1. For openings in grating separated by more than 4 bearing bars, provide banding of same material and size as bearing bars, unless otherwise indicated. Weld band to each bearing bar.
 - 2. Notching of bearing bars at supports to maintain elevations will not be permitted.
- F. Weld stainless steel stud bolts to receive saddle clip or flange block anchors to supporting steel members. Drill for machine bolts when supports are aluminum.
- G. Provide gratings in concrete with aluminum angle frames having mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected to assure flush fit.
- H. Provide gratings attached to existing concrete, masonry or steel with aluminum bearing angles fastened with anchors as shown or otherwise approved by ENGINEER.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fastening to In-Place Construction:
 - 1. Use anchorage devices and fasteners to secure grating to supporting members or prepared openings, as recommended by the manufacturer.
- B. Cutting, Fitting and Placement:
 - 1. Perform all cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack. Do not use wedges or shimming devices.

2. However gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and attach a strap collar not less than 1/8-inch thick to the cut ends of the bars.
 3. Divide the panels into sections only to the extent required for installation wherever grating is to be placed around previously installed pipe, ducts, and structural members.
 4. For contact surfaces between aluminum and concrete, masonry, steel, or other dissimilar surface use a coat of bituminous paint or other approved insulating material.
- C. Protection of Aluminum from Dissimilar Materials: Using approved asphaltic or zinc chromate paint, provide two heavy coats on aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel and other metals.

END OF SECTION 05535

SECTION 06100
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Providing openings in rough carpentry to accommodate the Work under this and other Sections and building into the rough carpentry all items such as sleeves, anchor bolts, inserts and all other items to be embedded in rough carpentry for which placement is not specifically provided under other Sections.

The types of rough carpentry Work required includes, but is not necessarily limited to, the following:

- a. Wood framing, blocking, furring strips and other miscellaneous wood framing.
- b. Plywood.
- c. Miscellaneous accessories, fasteners and anchorages.

1.2 QUALITY ASSURANCE

A. Design Criteria:

- 1. Lumber Standard: Comply with PS-20, except as otherwise specified.
- 2. State of Rhode Island Official Compilation of Codes, Rules and Regulations.

B. Codes: Comply with the applicable requirements of governing authorities and the State of Rhode Island Official Compilation of Codes, Rules and Regulations for size, spacing and attachment of wood members.

C. Source Quality Control:

1. Factory-mark each piece of lumber and type, grade, mill and grading agency.
2. Shop-fabricate rough carpentry Work to the extent feasible and where shop fabrication will result in better workmanship than feasible for on-site fabrication.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. American Lumber Standard Committee, National Grading Rule for Dimension Lumber, PS-20.
2. Occupational Safety and Health Act of 1970.
3. West Coast Lumber Inspection Bureau, Grading Rules.

1.3 PRODUCT DELIVERY STORAGE AND HANDLING

A. Storage of Materials:

1. Keep materials dry during delivery and storage.
2. Protect against exposure to weather and contact with damp or wet surfaces.
3. Stack lumber, and provide air circulation within stacks.

1.4 JOB CONDITIONS

- A. Coordination: Fit rough carpentry Work to other work and scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber, General:

1. Nominal sizes are shown, except as shown by detail dimensions. Provide actual sizes as required by American Lumber Standard Committee, National Grading Rule for Dimension Lumber PS-20, for the moisture content specified for each use.
 - a. Provide dressed lumber, S4S, unless otherwise shown or specified.
 - b. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing.
2. Provide the following grade and species:
 - a. Construction Grade.
 - b. Douglas Fir, WWP, or Southern Pine, SPIB.

B. Plywood:

1. Exterior Type: Grade CC/EXT-APA, 3/4-inch thick.
2. American Lumber Standard Committee, Plywood Standard, PS-1.

C. Fasteners and Anchorages:

1. Provide size and type as recommended by the State of New York Official Compilation of Codes, Rules and Regulations, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices.
2. Provide stainless steel nails for exterior Work. Zinc coated nails for all other uses.

D. Lumber for Protection and Temporary Support: Size and grades to meet applicable requirements of the Occupational Safety and Health Act of 1970 and structural requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR (and/or his installer) shall examine the substrates and supporting structure and the conditions under which the rough carpentry Work is to be installed, and notify ENGINEER in writing of the conditions detrimental to the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. General:

1. Discard units of material with defects which might impair the quality of the Work, and units which are too small to fabricate the Work with minimum joints or the optimum joint arrangement.

2. Set rough carpentry Work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
3. Securely attach rough carpentry Work to substrates by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed rough carpentry Work and fill holes. Use common wire nails, except as otherwise shown. Use finishing nails for finish Work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood, predrill as required.

B. Wood Grounds, Nailers, and Blocking

1. Provide wherever shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of Work to be attached. Coordinate location with other work involved.
2. Attach substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown.
3. Provide permanent grounds of dressed, preservative treated, keybevelled lumber not less than 1-1/2 inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

- C. Plywood: Install in accordance with the requirements of the State of Rhode Island Official Compilation of Codes, Rules and Regulations. Allow for installed clearances between individual plywood panels as specified by the plywood manufacturer.

END OF SECTION 06100

**SECTION 06400
PRE-ENGINEERED WALL PANELS**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install pre-engineered wall panels with expanded polystyrene (EPA) insulation.

1.2 RELATED SECTIONS

- A. Section 06100, Rough Carpentry.

1.3 SUBMITTALS

- A. Provide evidence of compliance with code requirements as an alternate method of construction.
- B. Each wall panel shall be accompanied with verified structural calculations by a registered architect or professional engineer qualified to perform such work.
- C. Manufacturer shall certify that panels have been tested in accordance with ASTM E 72 and ASTM E 119, ASTM E 84, and other applicable tests.
- D. Manufacturer shall supply a hard copy product certificate showing compliance to Third Party Quality Control.
- E. Provide Material Safety Data Sheet (MSDS) regarding panel material components.

1.4 QUALITY ASSURANCE

- A. Each panel shall be labeled indicating the maintenance of in-plant Quality Control/Third Party Inspection Service in compliance with national codes.
- B. Provide evidence of third party inspection and labeling of all insulation used in manufacture of panels. Both flame and physical characteristics will be covered by manufacturer's quality Control and Listing programs.
- C. Provide Lamination and R-Value Warranty documents for building owner acceptance and execution. Manufacturer's standard forms shall be submitted.

- D. Provide panels with insect treatment. Treatment must be EPA registered, with treatment efficacy substantiated by independent research and on-going in-plant testing.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All panels shall be stored in a protected area and supported to prevent contact with the ground.
- B. Prior to installation, panels shall be covered and protected from exposure to sunlight and moisture.
- C. After installation, all panels shall be covered to prevent contact with water on all exposed panel edges.

PART 2 PRODUCTS

2.1 WALL PANELS

- A. Provide a pressure laminated panel consisting of the following:
 - 1. Expanded polystyrene core - minimum of .95 pcf AFM Certified EPS complying with ASTM C 578 (other densities may be specified). Insulation manufacturer must provide certification of Third Party Inspection.
 - 2. OSB - shall be identified on the panel with an APA performance rating mark, with an Exposure 1 durability rating; minimum physical properties shall be tested and described in APA PRP-108.
 - 3. Adhesives - shall be an approved laminating adhesive having an in use temperature range of -40° to +250°F.
- B. Splines - splines for use in joining panels shall be supplied by panel manufacturer.
- C. Fasteners - shall be #14 corrosion resistant screws for roof, corners and attachment of panel to frames. In addition, zinc galvanized screws, nails or staples for spline and plate attachments. All fasteners as supplied by panel manufacturer.
- D. Caulk - a caulk compatible with all components of the panel and adjacent materials as supplied by the panel manufacturer.
- E. Construction Adhesive - adhesive for installing accessories and dimensional lumber to be supplied by panel manufacturer.

- F. Foam Sealant - a sealant compatible with all components of the panel and adjacent materials as supplied by the panel manufacturer.
- G. Install caulks, adhesives and sealants per manufacturer's details.
- H. Dimensional Lumber - SPF or white wood #2 or better or pre-engineered equivalent.

2.2 PERFORMANCE CHARACTERISTICS

- A. Sizes 4' x 8' up to 8' x 24'.
- B. Thermal Characteristics

R-Value Design Chart R-Control Structural Panel

Panel Thickness	R-Value at 75°F	R-Value at 40°F
4 1/2"	14.88	16.00
6 1/2"	22.58	24.33
8 1/4"	29.31	31.63
10 1/4"	37.00	39.88
12 1/4"	44.71	48.31

- C. Panels shall be manufactured in order to crate a 1/8" gap between sheathing edges to allow for movement and placement of caulk.
- D. Structural Testing - Each panel type shown on the drawings shall meet or exceed performance standards when tested in accordance with the following methods:
 - 1. Compressive Load
Test Method: ASTM E 72
 - 2. Transverse Load
Test Method: ASTM E 72
 - 3. Concentrated Load
Test Method: ASTM E 72
 - 4. Racking Load
Test Method: ASTM E 72

5. Combined Axial and ending
Test Method: ASTM E 72
6. Long Term Cold Creep Under Load
Test method: ASTM E 72
7. Tension Testing
Test Method: ASTM C 297
8. Impact Testing
Test Method: ASTM E 695
9. Accelerated Aging
Test Method: ASTM D 1183C
10. Insect Resistance Test
11. Full Scale Roof/Floor Diaphragm
Test Method: Modified ASTM E 455
12. Tested values shall meet or exceed those stated on manufacturer's load design charts and applicable technical data reports.

E. Fire Testing - The panel with approved finishes shall have successfully passed the following fire tests as conducted by testing agencies approved and listed by the model code. In addition, panel must be listed in current UL Directories, Sections BLBT, BXUV and BZXX.

1. UBC 17-5, Room Corner Burn Test.
2. ASTM E 119, 20 Minute with 3-Story load applied for the duration of the test.
3. ASTM E 119, One Hour with 3-Story load applied for the duration of the test followed by hose stream.
4. ASTM E 119, One-Hour Roof/Ceiling with design load applied for the duration of the test.
5. ASTM E 119 (small scale) 20-minute and One-Hour wall exposures with openings.
6. ASTM E 84 Surface Burning Characteristics conducted for the rigid insulation core.

7. ASTM E 84 Surface Burning Characteristics conducted for the interior and exterior surfaces of the finished panel.

F. Wind uplift and diaphragm capacity shall be calculated for recommended fastening of roof panels by a certified engineering professional.

2.3 MANUFACTURERS/CONTRACTORS

A. All components called for in this section to be supplied by the panel manufacturer shall be obtained from the selected manufacturer or its approved supplier.

B. Manufacturers:

1. AFM Corporation, Box 246, Excelsior, MN 55331
800-255-0176

2. Or equal.

C. All manufacturers seeking to qualify under this section shall submit all supporting documentation 30 days prior to the bid date.

PART 3 - INSTALLATION

3.1 GENERAL

A. The contractor shall inspect conditions of substrate, grade and other conditions which may affect the proper installation of panels. Any adverse conditions are to be reported in writing to the construction manager. Do not proceed with the installation until adverse conditions are corrected.

B. Installation shall be in strict accordance with manufacturer's published instructions, details and the drawings that are part of the contract documents for this project. Any conflicts between these documents shall be resolved in writing. All plans shall be reviewed by a qualified architect/engineer and shall be signed and/or sealed. Deviations from standard detail and load design values shall be calculated and signed and/or sealed by a qualified architect/engineer.

3.2 PROTECTION

- A. When storing panels, do not allow them to come into ground contact. Stored panels must remain dry. Do not allow panels to be stored in an unsupported manner. Improper storage may cause tolerance problems in the field.
- B. Roof panels must be fully protected from weather by roofing materials to provide temporary protection at the end of the day or when rain or snow is imminent.
- C. Remove and replace insulated wall or roof panels which have become excessively wet or damaged before proceeding with installation of additional panels or other work.
- D. All refuse created by the installation of the work in this section shall be removed by the construction manager.

END OF SECTION 06400

SECTION 08110
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install all hollow metal doors and frames.

The types of hollow metal doors and frames required includes, but is not necessarily limited to, the following:

- a. Flush doors and frames.
- b. Fire-rated flush doors and frames.
- c. Stick systems.
- d. Miscellaneous fabrications, anchors, reinforcements, fasteners and trim.

1.2 COORDINATION

- 1. Review installation procedures under other Sections and coordinate them with the Work specified herein.
- 2. Where hollow metal doors and frames Work require the building-in of plates, inserts and other items, furnish required inserts to avoid delay in the work of other trades. Provide setting drawings, templates, and directions for installation of plates, inserts and anchors, required by the Work of this Section but installed under other Sections of the Work.

1.3 RELATED SECTIONS

- 1. Section 04200, Unit Masonry Construction.
- 2. Section 06100, Rough Carpentry.
- 3. Section 08710, Door Hardware.
- 4. Section 09900, Painting.

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Provide hollow metal doors, frames and accessories manufactured by a single firm specializing in the production of this type of Work and complying with all applicable standards of the Steel Door Institute, recommended specifications for Standard Steel Doors and Frames (S.D.I. 100).
- B. **Requirements of Regulatory Agencies:**
 - 1. **Fire-rated Assemblies:** Wherever a fire-resistance classification is shown or scheduled for hollow metal doors and frames Work (3-hour, 1-1/2 hour, and similar designations), provide fire rated hollow metal doors and frames investigated and tested as an complete assembly including type of fire door hardware to be used. Identify each fire door, frame and stick system assembly with recognized testing laboratory labels, indicating applicable fire rating of both door, frame and stick system assembly.
 - 2. Construct assemblies to comply with NFPA Standard No. 80, and applicable provisions of the State of Rhode Island Official Compilation of Codes, Rules and Regulations.
 - 3. **Temperature Rise Rating:** Wherever a temperature rise rating is required provide doors for ratings as specified in accordance with UL 10(b).
 - 4. **Oversize Assemblies:** However hollow metal assemblies are larger than size limitations established by NFPA, provide manufacturer's certification that assembly has been constructed with materials and methods equivalent to labeled construction.
- C. **Reference Standards:** Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 - 1. ASTM A 153, Zinc Coating on Iron and Steel Hardware.
 - 2. ASTM A 366, Carbon Steel Cold-Rolled Sheet.
 - 3. ASTM A 525, Steel Sheet, Galvanized by the Hot-Dip Process General.
 - 4. ASTM A 526, Steel Sheet, Galvanized by the Hot-Dip Process - Specifications.

5. ASTM A 568, Carbon Steel and High Strength Low Alloy Hot Rolled Sheet, Hot Rolled Strip and Cold-Rolled Sheet.
6. ASTM A 569, Steel, Carbon Hot-Rolled Sheet and Strip.
7. ASTM E 152, Fire Tests of Door Assemblies.
8. Steel Door Institute Standard Steel Doors and Frames.
9. ANSI A115, Specification for Door and Frame Preparations for Hardware.
10. NFPA 80, Standard for Fire Doors and Windows.
11. NFPA 252, Fire Tests of Door Assemblies.
12. UL10(b), Fire Tests of Door Assemblies.
13. UL 63, Fire Door Frames.
14. U.L. Building Materials Directory.
15. National Association of Architectural Metal Manufacturers (NM MM), Hardware Locations for Custom Hollow Metal Doors.

1.5 SUBMITTALS

A. Samples: Submit for approval the following:

1. Metal frame, 12-inch by 12-inch "L" section of frame showing corner detail of all types specified.
2. Stick system frame, 12-inch by 12-inch section of frame showing corner detail and molding and gasket of all types specified.
3. Door, 12-inch by 12-inch section of all door types specified showing internal construction, edge detail and reinforcement for butts.

B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and installation of hollow metal doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and

installation requirements of finish hardware and reinforcements, and details of joints and connections.

2. Schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.

C. Test Reports: Submit for approval the following:

1. Certification of Labeled Construction Fire for Doors and Frames.
2. Certification of label construction for doors not requiring labels but requiring labeled construction.

D. Certificates: Submit for approval the following:

1. Oversize Fire-rated Doors and Frames: Certification for oversize fire-rated doors and frames that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver hollow metal doors and frames cartoned or crated to provide protection during transit and job storage.
2. Inspect hollow metal Work upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new Work and acceptable to ENGINEER; otherwise, remove and replace damaged items as directed.

B. Storage of Materials:

1. Store doors and frames at the building site under cover.
2. Place units up off the floors in a manner that will prevent rust and damage.
3. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrapper on the door becomes wet, remove the carton immediately.

4. Provide a 1/4 inch space between stacked doors to promote air circulation.

1.7 SCHEDULES

- A. Coordinate with other work by furnishing Shop Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Frames: Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Door Faces: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, millphosphatized.
- C. Supports and Anchors: Sheet metal, hot-dip galvanized after fabrication complying with ASTM A 153, Class B.
- D. Inserts, Bolts and Fasteners: Sheet metal, hot-dipped galvanized complying with ASTM A 153, Class C or D as applicable.

2.2 FABRICATION, GENERAL

- A. Fabricate hollow metal units to be rigid, neat in appearance and free of defects, warp or buckle. Accurately form metal to required sizes and profiles. Practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work, that cannot be permanently factory-assembled before shipment, to assure proper assembly at the project site. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Filler to conceal manufacturing defects is not acceptable.
- B. Exposed Fasteners: Unless otherwise specified, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Finish Hardware Preparation:

1. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115, Specifications for Door and Frame Preparation for Hardware. Drilling and tapping for surface applied finish hardware may be done at the site.
2. Reinforce hollow metal units to receive surface-applied and recessed finish hardware.
3. Locate finish hardware as shown on approved Shop Drawings, in accordance with hardware templates provided by hardware manufacturer and in accordance with National Association of Architectural Metal Manufacturers, Hardware Locations for Custom Hollow Metal Doors. Refer to Section 8H1, Finish Hardware.

D. Shop Painting:

1. Clean, treat and paint exposed surface of fabricated hollow metal units, including galvanized surfaces.
2. Clean steel surfaces of mill scale, rust, oil grease, dirt and other foreign materials before the application of the shop coat of paint.
3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT 2), hot phosphate solution (SSPC-PT 4) or basic zinc chromate-vinyl butyral solution (SSPC-PT 3).
4. Refer to Section 9L, Painting for field applied primer and finish paint for exterior or interior exposed ferrous, non-ferrous, or galvanized surfaces.
5. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a uniform dry film thickness of not less than 1.5 mils.
6. Finish shall be rust inhibitive primer capable of humidity test in accordance with ASTM B 117 as certified by an independent laboratory.

2.3 FLUSH DOORS

A. Door Types:

1. Provide flush design doors, 1-3/4-inches thick, seamless hollow construction, unless otherwise shown or specified.

B. Door Construction:

1. Fabricate doors of two outer stretcher-leveled steel sheets galvanized with a G60 zinc coating of 0.60 ounces per square foot in accordance with ASTM A 525 and A 526 and not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams or exposed faces or stile edges, except around glazed or louvered panel inserts. Provide continuously welded seams for all door construction. No fillers shall be used. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
2. Reinforce inside of doors with phenolic resin impregnated kraft 1-inch hexagonal cell honeycomb core completely filling the inside of the door and laminated to the inside of both face panels with an adhesive. The honeycomb material shall have a crushing strength not less than 4000 pounds per square foot and the lamination shall withstand not less than 1100 pounds per square foot in shear.
3. Door reinforcement may be modified in fabrication method approved by ENGINEER in order to provide a UL labeled fire rated door.
4. Reinforce tops and bottoms of doors with flushed mounted minimum 16 gage horizontal galvanized steel channels welded continuously to the outer sheets.
5. Edge profiles shall be provided on both stiles of doors as follows: beveled 1/8 inch in 2 inches.

C. Finish Hardware Reinforcement:

1. Refer to Section 08710, Door Hardware.
2. Hardware supplier shall furnish hollow metal door and frame manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to insure correct fitting and installation.
3. Preparation includes sinkages and cut-outs for mortise and concealed hardware.

4. Provide reinforcements for both concealed and surface applied hardware:
 - a. Drill and tap mortise reinforcements at factory, using templates.
 - b. Install reinforcements with concealed connections designed to develop full strength of reinforcements.
5. Reinforce doors for required finish hardware, with minimum gages as follows:
 - a. Hinges: Steel plate 1/4-inch gage thick by 1-1/2-inches wide by 8-inches longer than hinge secured by not less than 6 spot or projection welds.
 - b. Mortise Locksets and Dead Bolts: 12 gage steel sheet, secured with not less than 2 spot or projection welds.
 - c. Flush Bolts: 12 gage steel sheet, secured with not less than 2 spot or projection welds.
 - d. Surface-Applied Closers: 1/4-inch thick steel plate, secured with not less than 6 spot or projection welds.
 - e. Push Plates and Bars: 16 gage steel sheet secured with not less than 2 spot or projection welds.
 - f. Surface Panic Devices: 16 gage sheet steel secured with not less than 2 spot or projection welds.
 - g. Automatic Door Bottoms: Reinforce for mortise-type units with 14 gage steel, and 16 gage for surface-applied units.

D. Product and Manufacturer: Provide one of the following:

1. Series CH with DURA-WELD seams by Pioneer Industries, Division of SOS Consolidated, Incorporated.

2.4 FIRE-RATED DOORS

- A. Provide the same construction specified above under door construction and within UL requirements as specified.

- B. Provide fire-rated doors in accordance with Underwriters' Laboratories Standard, UL 10(b), and NFPA No. 80 and as follows:
1. For a UL 3-hour (A) classification provide doors with a temperature rise rating of not more than 250 F maximum to 30 minutes of exposure.
 2. For a UL 1-1/2 hour (B) classification provide doors with a temperature rise rating of not more than 450 F or 650 F maximum to 30 minutes of exposure.
- C. Provide fire-rated doors with metal labels permanently fastened to the door. Labels shall display all UL required information.
- D. Product and Manufacturer: Provide one of the following:
1. Series CH Underwriters' Label Doors with DURA-WELD seams by Pioneer Industries, Division of SOS Consolidated, Incorporation.

2.5 FRAMES

- A. Frame Types: Provide hollow metal frames for doors, and other openings of size and profile as shown or specified.
- B. Frame Construction:
1. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame with exposed welds ground flush and smooth.
 2. Form frames of hot rolled prime quality carbon steel in accordance with ASTM A 568 and A 569 and galvanized with a G60 zinc coating of 0.60 ounces per foot in accordance with ASTM A 153, A 525, and A 526 or cold rolled steel sheets in accordance with ASTM A 366 and galvanized in accordance with ASTM A 153, A 525 and A 526.
 3. Gage thickness of steel: not less than 14.
 4. Finish Hardware Reinforcement: Reinforce frames for required Finish hardware with minimum gages as follows:
 - a. Hinges and Pivots: Steel plate 1/4-inch gage thick by 1-1/2-inches wide by 8-inches longer than hinge, secured by not less than 6 spot or projection welds.

- b. Strike Plate Clips: Steel plate 10 gage thick by 1-1/2-inches wide by 3-inches long.
 - c. Surface-Applied Closers: 1/4-inch thick steel plate, secured with not less than 5 spot or projection welds.
5. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at the top so they can be filled with grout.
6. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 16 gage galvanized steel.
- a. Masonry Construction (except as otherwise shown): Adjustable, corrugated or perforated, T-shaped to suit frame size with leg not less than 2-inches wide by 10-inches long. Furnish at least 3 anchors per jamb up to 7 feet 6 inches height; 4 anchors up to 8 feet-0 inch jamb height; one additional anchor for each 24 inch or fraction thereof over 8 feet-0 inch height. Furnish UL construction where required.
 - b. Cast-In-Place Concrete: Anchor frame jambs with minimum 3/8-inch concealed bolts into expansion shields or inserts at 6-inches from top and bottom and 24-inches on centers. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts.
7. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet, clip type anchors, with 2 holes to receive fasteners, welded to bottom of jambs and mullions.
8. Head Anchors: Provide 2 anchors at head of frames exceeding 42 inches wide frames mounted in drywall partitions.
9. Head Strut Supports: Provide 3/8-inch by 2-inch vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.

10. Head Reinforcing: For frames over 4 feet-0 inch wide, in masonry openings, provide continuous steel channel or angle stiffener, not less than 12 gage for full width of opening, welded to back of frame at head.
11. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
12. Rubber Door Silencers: Drill stop to receive 3 silencers on single-door frames and 4 silencers on double-door frames. Install plastic plugs to keep holes clear during construction.
13. Product and Manufacturer: Provide one of the following:
 - a. Series F-14 by Pioneer Industries, Division of SOS Consolidated, Incorporated.
 - b. Or equal.

2.6 FIRE-RATED FRAMES

- A. Provide the same construction specified above under frame construction and within UL and NFPA requirements as specified above.
- B. Provide fire-rated frames with metal labels permanently fastened to the frame. Labels shall display all UL required information.
- C. Provide fire-rated frames in accordance with UL Standards UL 10 (b) and UL 63 and NFPA Pamphlet No. 80 and as listed in UL.
- D. Product and Manufacturer: Provide one of the following:
 - a. Series F-14 Underwriters' Label Frames by Pioneer Industries, Division of SOS Consolidated Incorporation.

2.7 STOPS AND MOULDINGS

- A. Provide stops and mouldings around solid, glazed and louvered panels in hollow metal units and in frames to receive glass.
- B. Form fixed stops and mouldings integral with frame. Provide fixed stops on inside of hollow metal units exposed to exterior and on corridor side of interior units.

- C. Provide removable stops and molds at other locations, formed of not less than galvanized 20 gage steel sheets. Secure with countersunk machine screws spaced uniformly not more than 12 inches on center. Form corners with butted hairline joints.
- D. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and conditions under which hollow metal doors and frames are to be installed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install hollow metal units and accessories in accordance with the final Shop Drawings, manufacturer's data, and as shown and specified.
- B. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
- C. Frames that are bowed, twisted or otherwise unacceptable shall be removed from the jobsite and replaced with properly constructed frames.
- D. Setting Masonry Anchorage Devices:
 - 1. In masonry construction, building in of anchors and grouting of frames is included in Section 4C1, Unit Masonry Construction.
 - 2. Provide masonry anchorage devices and machine screws where required for securing hollow metal frames to masonry construction.
 - 3. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

4. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so shown on final Shop Drawings.
- E. Secure frames to concrete framing with reinforcement concealed in hollow metal frames.
- F. Placing Frames:
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Remove spreader bars only after frames have been properly set and secured.
 2. Make field splices in frames as detailed on approved Shop Drawings, welded and finished to match factory Work.
- G. Protective Coating: Protect inside, concealed, faces of door frames in plaster or masonry construction using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.
- H. Door Installation:
1. Fit hollow metal doors accurately in their respective frames, with the following clearances:
 - a. Jambs and Head: 3/32 inch.
 - b. Meeting Edges, Pairs of Doors: 1/8 inch.
 - c. Bottom: 3/4 inch, where no threshold or carpet.
 - d. Bottom: At threshold, 1/8 inch.
 2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
 3. Finish hardware installation is specified under Section 8H1, Finish Hardware.

3.3 ADJUSTMENT AND CLEANING

- A. Final Adjustments: Check and readjust operating finish hardware items in hollow metal Work just prior to final inspection. Leave Work in complete and proper operating conditions.
- B. Prime Coat Touch-Up: Immediately after erection, sand and apply touch-up of compatible air-drying primer.
- C. Protection: Protect installed hollow metal doors and frames against damage from other construction work.

END OF SECTION 08110

SECTION 08300
OVERHEAD ROLLING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install galvanized steel weatherstripped overhead rolling door with insulated slats, electric operator, control stations, starters, safety edge device and associated components.

1.2 RELATED SECTIONS:

- 1. Section 09900, Painting.
- 2. Section 16120, 600 Volt Cable.

1.3 QUALITY ASSURANCE

- A. Design Criteria: Design and reinforce overhead rolling door to withstand a wind loading pressure 30 pounds per square foot.
- B. Source Quality Control: Provide overhead rolling doors as complete units produced by a single manufacturer specializing in the production of this type of Work, including hardware, accessories, mounting and installation components.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 - 1. National Electrical Manufacturers Association (NEMA), Standard KS 1-1969.

1.4 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. All components and installations as shown or specified.
2. Copies of manufacturer's specifications, roughing-in diagrams, and installation instructions for rolling door. Include manufacturer's data, operating instructions and maintenance data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver doors and frames cartoned or crated to provide protection during transit and job storage.
2. Inspect metal Work upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new Work and acceptable to ENGINEER; otherwise, remove and replace damaged items as directed.

B. Storage of Materials: Store overhead rolling doors at the building site under cover. Place units up off the floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber.

PART 2 PRODUCTS

2.1 MATERIALS

A. Door Curtain:

1. Door Curtain Slats: Fabricate overhead rolling door curtain of flat interlocking slats designed to withstand the specified wind loading but not less than 20 gage galvanized steel, of continuous length for the width of the door without splices. Unless otherwise shown or specified, provide slats of the material gage recommended by the door manufacturer for the size and type of door and finish required, as follows:
 - a. Galvanized Steel Door Curtain Slats: Provide double face slats, 5/8-inch thick, with galvanized finish.
 - b. Provide slats completely filled with glass fiber reinforced polyisocyanurate foam plastic with aluminum foil facers with a minimum "R" value of 5.0 and UL Flame Spread 25 maximum.
2. Windlocks: Provide continuous internal bent lock bar. Fit both sides of guide with flexible strip.
3. Bottom Bar: Furnish bottom bar consisting of two galvanized steel angles, each not less than 1-1/2-inches by 1-1/2-inches by 1/8-inch thick.

B. Curtain Jamb Guides:

1. Fabricate curtain jamb guides of galvanized steel with sufficient depth and strength to retain the curtain against specified wind loading. Build-up units with minimum 3/16-inch thick steel sections complying with ASTM A-36. Slot bolt holes for track adjustment.
2. Secure continuous galvanized steel wall angle to wall framing by 3/8-inch minimum stainless steel bolts at not more than 30 inches of center, unless otherwise recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise shown. Place anchor bolts on exterior wall guides so that they are concealed when door is in closed position. Provide removable stops on guides to prevent overtravel of curtain.

C. Weather Seals:

1. Provide natural rubber or neoprene rubber weatherstripping for exterior doors. Secure weather seals with continuous metal pressure bars. At door heads, use a 1/8-inch thick continuous sheet secured to the inside of the curtain coil hood. At door jambs, use a 1/8-inch thick continuous strip secured to the exterior side of the jamb guide.
2. Provide double guide weatherstripping which when tested at 1.30 pounds per square foot pressure differential allows 3.75 cubic feet per minute air infiltration per linear foot of overhead rolling door perimeter maximum.
3. Provide weatherstripping around all edges of door, including hood baffle, astragal, and guide weatherstripping.

D. Counterbalancing Mechanism:

1. Counterbalance doors by means of an adjustable steel helical torsion spring mounted around a galvanized steel shaft and mounted in a spring barrel and connected to the door curtain with the required barrel rings. Use grease-sealed ball bearings or self-lubricating graphite bearings for all rotating members.
2. Counterbalance Barrel:
 - a. Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support the roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03 inch per foot of span under full load.
 - b. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance the weight of the curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to the barrel and the shaft.

- c. Fabricate torsion rod for counterbalance shaft of casehardened steel, of required size to hold the fixed spring ends and carry the torsional load.
- 3. Brackets: Provide mounting brackets of manufacturer's standard design, of cold-rolled stainless steel plate with bell-mouth guide groove for curtain.
- 4. Hood:
 - a. Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as a weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
 - b. Fabricate hoods of 16 gage galvanized steel sheet with prime coat compatible with finish specified in Section 09900, Painting.
- E. Product and Manufacturer: Provide one of the following:
 - 1. AIR-BAR Door with AIR-BAR F3B Flat Slat by North American Rolling Door Incorporated.

2.2 ACCESSORIES

A. Electric Door Operator:

- 1. General: Furnish electric door operator assembly of the size and capacity recommended and provided by the door manufacturer; complete with electric motor and factory-prewired motor controls, including starter, gear reduction unit, solenoid operated brake, clutch, remote control stations, and control devices and wiring.

2. Provide a hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so that they are accessible from floor level. Include an interlock device to automatically prevent the motor from operating when emergency operator is engaged.
3. Design operator so that motor may be removed without disturbing the limit-switch adjustment and without affecting the emergency auxiliary operator.
4. Door Operator Type:
 - a. Provide wall or bracket-mounted door operator units consisting of an electric motor, a worm gear drive from motor to reduction gear box, a chain or worm gear drive from reduction box to a gear wheel mounted on the counterbalance shaft, and a quick-clutch disconnect-release for manual operation.
 - b. Provide motor, clutch, and drive assembly of horsepower and design as determined by the door manufacturer for the size of door required and as herein specified.
5. Electric Motor:
 - a. Provide high-starting torque, reversible, constant duty, Class A insulated electric motors with overload protection.
 - b. Provide maximum 1 horsepower motor suitable for 480 volt 3-phase supply or motor sized by manufacturer, sized to move door in either direction, from any position, at not less than 8 inches nor more than 12 inches per second.

- c. Coordinate wiring requirements and current characteristics of motors with the building electrical system; see Division 16 Sections of these Specifications.
 - d. Provide totally enclosed, fan cooled (TEFC) type, waterproof electric motor, fitted with a plugged drain.
6. Remote Control Station:
- a. Unless otherwise shown, provide momentary-contact, 3-button control station with push button controls labeled "open", "close" and "stop".
 - b. Provide interior units, full-guarded type, surface-mounted, heavy-duty, with NEMA 4X enclosure, key operated.
7. Safety Edge Device:
- a. Provide overhead rolling door with an electric safety switch, extending full width of the door bottom, and located within a U-shaped neoprene or rubber astragal mounted to the bottom door rail.
 - b. Design the unit to operate such that contact with the switch before fully closing will immediately stop the downward travel and reverse the direction to the fully opened position.
 - c. Connect to the control circuit through a retracting safety cord.
 - d. The compressible strip shall also serve as a weatherseal along the bottom of the door.

2.3 PAINTING

- A. Shop clean and prime all ferrous metal and galvanized surfaces, exposed and unexposed, except lubricated surfaces, with door manufacturer's standard rust inhibitive primer drying to a flat sheen.
- B. Refer to Section 09900, Painting, to coordinate shop and field prime and finish paint of interior and exterior ferrous and non-ferrous metals.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the substrates and conditions under which the Work is to be installed and notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 INSTALLATION

- A. Install, wire, connect and adjust doors, motors, starters, pushbutton stations, limit and safety switches and all other electrical accessories and connections required in full accordance with the manufacturer's written instructions, the approved Shop Drawings and as shown and specified.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation including the work by other trades, test and adjust doors to operate easily, free from warp, twist or distortion.
- B. Test the door in presence of the ENGINEER to demonstrate compliance with the Specifications and the manufacturers design criteria.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust mechanism so moving parts operate smoothly.
- B. Repair damage, and rolling doors, and match manufacturer's original finish.
- C. Leave work area clean and free of debris.

END OF SECTION 08300

SECTION 08710
DOOR HARDWARE

PART 1 GENERAL

1. 1 SECTION INCLUDES

- A. Furnish and install all door hardware. Door hardware is defined to include all items known commercially as finish hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same Section as the door and door frame.
- B. The types of finish hardware Work required includes, but is not necessarily limited to, the following:
 - a. Mortise hinges.
 - b. Locksets.
 - c. Latchsets.
 - d. Panic exit devices.
 - e. Door closers.
 - f. Overhead holders and stops.
 - g. Stops.
 - h. Silencers.
 - i. Stripping and seals.
 - j. Thresholds.
 - k. Miscellaneous items.

1.2 RELATED SECTIONS

- 1. Section 08110, Hollow Metal Doors and Frames.
- 2. Section 08300, Overhead Rolling Doors.

1.3 QUALITY ASSURANCE

- A. Supplier Qualifications: The finish hardware supplier shall have in his employ a member of the American Society of Architectural Hardware Consultants who shall be responsible for checking and supervising the complete finish hardware installation.
- B. Design Criteria:
 - 1. Where the finish, shape, size or function of a member receiving finish hardware is such as to prevent the use of, or make unsuitable the types specified, furnish similar types having as nearly as practicable the same operation.
 - 2. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware for comparable openings.
 - 3. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.
 - 4. Unless otherwise specified, comply with the National Builders Hardware Association, "Recommended Locations for Builders Hardware".
 - 5. Provide stainless steel finish hardware, or matching finish hardware as specified, for all doors and frames.
- C. Requirements of Regulatory Agencies:
 - 1. Provide finish hardware for fire-rated openings in compliance with NFPA No. 80. This requirement takes precedence over other requirements for such finish hardware.
 - 2. Provide only finish hardware which has been tested, listed and labeled by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels. Modify scheduled finish hardware, as required, to meet UL requirements.
 - 3. Codes: Comply with the applicable requirements of governing authorities and codes for the types of finish hardware specified.
- D. Source Quality Control: To the greatest extent possible, obtain each type of finish hardware from only one manufacturer.

E. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified:

1. FS TT-S-001657, Sealing Compound - Single Component, Butyl Rubber Based, Solvent Release Type.
2. National Fire Protection Association, Standard for Fire Doors and Windows No. 80.
3. UL, Building Materials Directory.
4. UL, List of Inspected Fire Protection Equipment and Materials.
5. UL, Hardware, Automatic Flush or Surface Bolts.
6. National Builders Hardware Association, Recommended Locations for Builders Hardware.

1.4 SUBMITTALS

A. Samples: Submit for approval each item of finished hardware with specified finish.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.
2. Copies of the finish hardware schedule. Include a separate key schedule, showing clearly how final instructions on keying of locks have been fulfilled. Finish hardware schedules are intended for coordination of the Work. Review and acceptance by ENGINEER does not relieve CONTRACTOR of his exclusive responsibility to fulfill the requirements as shown and specified.
3. Based on the finish hardware requirements specified, organize the final finish hardware schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other work (such as hollow metal frames) which may be critical in the Project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with Shop Drawings for other work, delivery schedules and

similar information have been completed and accepted.

4. Maintenance Manual: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - a. Product names and numbers.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Complete repair, installation and parts manuals for all items.
 - d. Detailed procedures for routine maintenance and cleaning.
 - e. Detailed procedures for light repairs such as dents, scratches and staining.
5. Complete information on required maintenance tools to be furnished as recommended by the finish hardware manufacturer.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver finish hardware sufficiently in advance of its setting for proper inspection.
2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with the approved finish hardware schedule.

B. Storage of Materials:

1. Provide secure lock-up for finish hardware stored at the site, but not yet installed.
2. Store finish hardware in manufacturers' original packages.

C. Handling of Materials: Control the handling and installation of finish hardware items which are not immediately replaceable, so that the completion of the Work will not be delayed by finish hardware losses, both before and after installation.

1.6 JOB CONDITIONS

- A. Scheduling: Deliver individually packaged finish hardware items at the proper time to the proper locations for installation.

1.7 SUBSTITUTIONS

- A. Do not make substitutions after ENGINEER's approval of final finish hardware schedule.
- B. Clearly identify all proposed substitutions and provide complete comparative data with specified product at time of Shop Drawing submission.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General:

1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels.
3. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.
4. Fasteners: Manufacture finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware which has been prepared for selftapping sheet metal screws, except as specifically indicated.
5. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces on other Work, to match the finish of such other Work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.
 7. Provide concealed fasteners for finish hardware units which are not exposed when the door is closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.
 8. Tools for Maintenance: Furnish a complete set of specialized tools as needed for ENGINEER's continued adjustment, maintenance, removal and replacement of finish hardware.
- B. Mortise Hinges: Provide all doors with mortise hinges unless specifically scheduled as receiving pivot hinges:
1. Templates and Screws: Provide only template-produced units.
 2. Base Metal: Fabricate hinges from stainless steel and finish to match the latch and lock set.
 3. Number of Hinges: Except as otherwise specified, provide 2 hinges on each door leaf of less than 60-inches height; provide one additional hinge for next 30-inches of door height; provide two additional hinges for each 30-inches or fraction thereof for doors above 90-inches tall.
 4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Interior and Exterior Doors, maximum 36-inches wide: 4-1/2 inch heavy weight (0.180-inch).
 - b. Wide Exterior and Interior Doors:
 - 1) Maximum 47-inches Wide: 5-inch heavy weight (0.190 inch).
 - 2) 48-inches Wide and Over: 6-inch heavy weight (0.203 inch).
 5. Types of Hinges: Provide full-mortise type, ball-bearing hinges swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.

6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:
 - a. Pins: Stainless steel.
 - b. Exterior Doors: Non-removable pins.
 - c. Tips: Hospital tips and matching plug, finished to match leaves.
7. Product and Manufacturer: Provide one of the following:
 - a. FBB 199H by The Stanley Works.
 - b. T4B3386H by McKinney Manufacturing Company.
8. Comply with UL, List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.

C. Mortise Locks and Latch Sets:

1. Strikes: Provide manufacturer's standard wrought box strike, for each location and use shown. Provide stainless steel curved lip strikes, unless otherwise recommended by manufacturer, finished to match lock or latch set trim.
2. Lock Throw: Provide minimum of 3/4-inch anti-friction latch bolt and 1-inch dead bolt throw wherever available on manufacturer's functions specified. Comply with UL requirements for throw of latchbolts and deadbolts on fire-rated openings.
3. Materials: Provide the following materials: a. Latch Bolt: Stainless steel. b. Dead Bolt: Stainless steel. c. Case: Heavy gage steel with corrosion resistant finish. d. Hub: Stainless steel. e. Scalp: Bronze finished to match trim specified. f. All components shall be of marine quality wherever possible.
4. Backset: Provide minimum backset of 2-3/4-inches.
5. Modify specified locks and latches to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
6. Finish: US 32D stainless steel.
7. Product and Manufacturer: Provide one of the following:

- a. Heavy-Duty Mortise Lock 9700 Series 773L Design with LE2 Escutcheon (US 32D) by Corbin Division of Emhart Corporation.
- b. Heavy-Duty Mortise Lock A7000 Series LusMo-LE (US 32D) by Russwin, Division of Emhart Corporation.

D. Panic Exit Devices:

1. Strikes: Provide manufacturer's standard wrought steel open back strikes for each location and use shown to allow independent opening and closing of each leaf of double doors with panic exit devices. Comply with UL, List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
2. Exit Doors: Where required by governing regulations or where shown or scheduled, provide panic exit devices, of the type required.
3. Fire Doors: Where shown or specified as a fire-rated door, provide units listed and labeled by UL to comply with the rating and size of door shown.
4. Lock Throws: Provide minimum of 3/4-inch latch bolt throw.
5. Provide surface mounted vertical rod type exit device and mortise type exit devices as specified.
6. Provide the following materials:
 - a. Latch Bolt: Brass.
 - b. Case: Heavy gage chrome plated steel.
 - c. Cylinders: Bronze.
 - d. Front: Heavy gage steel.
 - e. Chassis: Brass.
 - f. Crossbar: Stainless steel, 0.062-inches minimum thickness, with steel reinforcing tube.
 - g. Surface Mounted Bolts: Minimum 1/2-inch diameter stainless steel.
7. Backset: Provide minimum backset of 2-3/4-inches.

8. Finish: US 32D stainless steel.
9. Product and Manufacturer: Provide one of the following:
 - a. 3126 1/2 for single doors and 3126 1/2 x 3245U-73 for double doors 31MG Design (US 32D) by Corbin Division of Emhart Corporation.
 - b. 796 1/2 for single doors and 796 1/2 x U771-73 for double doors 7415 Modera (US 32D) by Russwin Division of Emhart Corporation.

E. Cylinders and Keying System:

1. Review the keying system with CONTRACTOR and provide the type required (master, grandmaster or greatgrandmaster).
2. Equip all locks with manufacturer's special 6-pin tumbler cylinder, with construction master key feature, which permits voiding of construction keys without cylinder removal.
3. Comply with the ENGINEER's instructions for masterkeying and, except as otherwise specified, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
4. Key Material: Provide keys of nickel silver only.
5. Key Quantity: Furnish 3 keys for each lock and each master and grandmaster system. Provide one extra key blank for each lock.
6. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the project. Provide a hinged-panel type cabinet, for wall mounting.

F. Door Closers:

1. Provide all doors, both active and inactive, with door closers, unless otherwise specified.
2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use.

3. Where parallel arms are specified, and for closers on exterior doors, provide closer unit one size larger than recommended for use with standard arms.
4. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.
5. Modify closers specified as required to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials, and NFPA No. 80 for doors requiring door closers.
6. Provide hold open feature for all non-fire rated doors unless otherwise specified.
7. Select all arms to clear weatherstripping, and overhead door holders.
8. Provide long arm to allow door to swing 180 degrees where long arm will eliminate floor mounted stops and as shown.
9. Provide closers with spring power adjustment feature capable of increasing spring power 50 percent minimum in all closer sizes.
10. Provide closer with delayed closing action feature. Position valve at top of closer.
11. Provide individual regulating valves for closing and latching speeds, and separate adjustable backcheck valve.
12. Material: Provide the following materials: a. Metallic Cover: Aluminum US 27. b. Case: Cast iron. c. Other Parts: Steel.
13. Finish: Color coordinate all arms and other accessories.
14. Product and Manufacturer: Provide one of the following:
 - a. 110 Series Door Closers by Corbin, Division of Emhart Corporation.
 - b. DA 2810 Series Door Closers by Russwin, Division of Emhart Corporation.

G. Holders and Stops:

1. Provide concealed overhead holders and stops on all exterior doors and as specified; with hold open feature. Comply with UL and NFPA requirements.

2. Material: Provide the following materials: a. Shock Absorber Spring: Heavy tempered steel. b. All other Parts: Extruded bronze.
3. Coordinate placement of overhead holder and stop with arm and bracket selection for door closers, for non-interference.
4. Two types of holders and stops are required as follows:
 - a. For all door leaves with maximum width of 3 foot-0 inches provide the following:
 - 1) Product and Manufacturer: Provide one of the following:
 - a) GJ100A Series Heavy Duty Concealed Overhead Door Holder by Glynn Johnson Corporation.
 - b. For all door leaves wider than 3 foot-0 inches provide the following:
 - 1) Design extra heavy-duty surface mounted door holders and connections where they are fastened to other materials, to resist a superimposed load of 30 pounds per square foot acting on the plane of the doors.
 - 2) Provide extra heavy-duty units at head of each leaf which shall engage and release door automatically by roller cam action with a provision at the end of the arm to regulate the hold-open tension or place it in a neutral position.
 - 3) Provide 3/4-inch diameter steel arm, all other parts shall be cast bronze.
 - 4) Provide all manufacturer recommended door reinforcements and coordinate the furnishing of hardware templates required for the installation of the units.
 - 5) Finish: US 32D stainless steel.
 - 6) Product and Manufacturer: Provide one of the following:
 - a) GJ79HD by Glynn-Johnson Division of Dayton-Walther Corporation.

H. Stops:

1. All doors shall have stops. Provide wall stops for all interior doors wherever possible. Provide long arms on closers where possible in order to avoid use of floor stops.
2. Materials: Chassis with grey rubber tip.
3. Finish: US 3S 32D stainless steel.
4. Provide concealed stainless steel fasteners as required by the substrate.
5. Product and Manufacturer: Provide one of the following:
 - a. WB60MX wall mounted concave series type series by Glynn Johnson Division of Dayton-Walther Corporation.

I. Stripping and Seals:

1. Provide perimeter weather stripping at all exterior doors and as specified.
2. Continuity of Stripping: Except as otherwise specified, it is required that the stripping at each opening be continuous and without unnecessary interruptions at door corners and hardware.
3. Replaceable Seal Strips: It is required that the resilient or flexible seal strip of every unit be easily replaceable and readily available from stocks maintained by the manufacturer.
4. Provide bumper type weather stripping at jambs and head, including a resilient insert and metal retainer strip, surface-applied, of the following metal, finish and resilient bumper material:
 - a. Housing: Extruded aluminum with clear anodized finish; 0.062-inch minimum thickness of main walls and flanges.
 - b. Seals: Closed cell extruded sponge neoprene.
5. Product and Manufacturer: Provide one of the following:
 - a. No. 350CSR by Pemko Manufacturing Company.

6. Provide automatic drop-seal sound-stripping door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar, and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting on doors as follows:
 - a. Housing: Extruded aluminum, 0.062-inch thick, with clear anodized finish on exposed surfaces.
 - b. Seal: Closed-cell sponge neoprene.
 - c. Mounting: Semi-montise mounted. Mount on stop-face of doors, except mount on hinge-face of swing-in exterior doors.
7. Product and Manufacturer: Provide one of the following:
 - a. No. 430CMR by Pemko Manufacturing Company.

J. Thresholds:

1. Provide thresholds on all exterior doors. Interior doors shall be provided with thresholds as scheduled.
2. Metal: Extruded aluminum.
3. Surface Pattern: Grooved tread, manufacturer's standard.
4. Provide countersunk bronze screws and expansion shields.
5. Width: 5-inches wide and full width of opening.
6. Construction:
 - a. Single-piece, complying with manufacturer's recommendations.
7. Profile: Provide manufacturer's standard unit which conforms with the minimum size and profile requirements specified.
 - a. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.
8. Thickness: 1/4-inch minimum.

9. Product and Manufacturer: Provide one of the following:

- a. 171 and 227 with 196 by Pemko Manufacturing Company.

K. Silencers:

- 1. Provide silencers for all non-fire rated door frames.

2. Product and Manufacturer: Provide one of the following:

- a. No. 3446 by Sargent and Company.

L. Sealants: Provide butyl rubber sealant complying with FS TT-S-001657 for use with thresholds.

2.2 HARDWARE FINISHES

- A. Provide matching finishes for finish hardware units at each door or opening, to the greatest extent possible. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR (and/or his installer) shall examine the substrate to receive finish hardware, and ascertain the conditions under which the Work will be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the finish hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Templates: Furnish finish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of finish hardware. Upon request, check the Shop Drawings of such other work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

3.3 INSTALLATION

- A. Mount finish hardware units at heights recommended in, "Recommended Locations for Builders' Hardware," by National Builders Hardware Association, except as otherwise specified or required to comply with governing regulations.
- B. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install finish hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.
- F. Screw thresholds to substrate with No. 10 or larger bronze screws, of the proper type for permanent anchorage.
- G. Set thresholds in a bead of butyl rubber sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust and check each operating item of finish hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.
- B. Final Adjustment: Where finish hardware installation is made more than one month prior to Final Acceptance or occupancy of a space or area, return to the Work during the week prior to Final Acceptance or occupancy, and make a final check and adjustment of all finish hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of finish

hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.

- C. Instruct OWNER's personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.
- D. Finish hardware which is blemished or defective will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other work.
- E. Continued Maintenance Service: Approximately 6 months after the acceptance of finish hardware in each area, the installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct OWNER's personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace finish hardware items which have deteriorated or failed due to faulty design, materials or installation of finish hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the finish hardware.

3.5 SCHEDULES

- A. Scheduled items for each door are generic and rely on information specified above. The listing of hardware types provided is only a general guideline for the final finish hardware schedule. CONTRACTOR shall submit a finish hardware schedule acceptable to all codes and testing agencies.

END OF SECTION 08710

SECTION 09880
PROTECTIVE CONCRETE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install all concrete toppings in the equipment areas.

1.2 COORDINATION

- A. Coordinate and schedule sandblasting of substrates before equipment and similar items are installed to avoid later difficulty or delay in performing the Work of this section.
- B. Coordinate the protection of existing equipment to remain in place during substrate preparation.
- C. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the concrete toppings.
- D. Coordinate the finishing of substrates for acceptability of substrates to concrete toppings manufacturers.
- E. Coordinate floor drain mounting heights and types. Provide floor drain type which accommodates 1/4-inch thick concrete floor toppings.
- F. Remove all chemicals, compounds and other materials from substrates to receive the Work of this Section, as may be required by the concrete toppings manufacturers, at no additional expense to OWNER even if chemicals, compounds and other materials are permitted by other Sections of this Specification.

1.3 RELATED SECTIONS

- 1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications: Certified or licensed by the flooring materials manufacturer.

- B. Source Quality Control: Provide each component of concrete topping produced by a single manufacturer, including recommended primers (if any), base coat, aggregate, and top coat materials.
- C. Allowable Tolerances: Provide the following:
1. Finished toppings level to 1/8 inch in 10 feet-0 inches.
 2. Smooth, continuous color with no color streaks or inconsistencies.
 3. Uniformly textured non-slip finish.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM C 109, Compressive Strength of Hydraulic Cement Mortars.
 2. ASTM C 150, Portland Cement.
 3. ASTM C 190, Tensile Strength of Hydraulic Cement Mortars.
 4. ASTM C 321, Bond Strength of Chemical-Resistant Mortars.
 5. ASTM C 501, Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
 6. ASTM D 696, Test for Coefficient of Linear Thermal Expansion of Plastics.
 7. ASTM D 790, Test of Flexural Properties of Plastics.
 8. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 9. ASTM D 2240, Rubber Property-Durometer Hardness.
 10. ASTM E 84, Surface Burning Characteristics of Building Materials.
 11. Military Specification, MIL-3134F.

1.5 SUBMITTALS

- A. Samples: Submit for approval the following:

1. 12-inch by 12-inch samples of each type of concrete toppings on plywood. Show range of color and pattern variation. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
2. After samples have been approved, a sample of concrete toppings shall be applied to floor areas selected by ENGINEER. Upon acceptance by ENGINEER, the samples shall be the standard by which all Work shall be compared.

B. Shop Drawings: Submit for approval the following:

1. Show floor plans indicating where concrete toppings occurs in each space. Show interface details with other items occurring in the spaces such as thresholds, floor drains, coves, equipment pads and trench drains or horizontal pipe chases.
2. Copies of manufacturer's technical data and installation instructions for concrete topping required.
3. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices.
4. Test Reports: Copies of test data from an independent testing laboratory for all the physical properties listed herein.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver material in manufacturer's original unopened and undamaged packages.
2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
3. Packages showing indications of damage that may affect condition of contents are not acceptable.

B. Storage of Materials:

1. Store in original packaging under protective cover and protect from damage.

2. Stack containers in accordance with manufacturer's recommendations.
- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.7 JOB CONDITIONS

A. Environmental Requirements:

1. Maintain substrate temperature and room temperature before, during and after installation above 50° F and in accordance with flooring material manufacturer's instructions.
2. Provide adequate ventilation during application and curing periods.

B. Scheduling:

1. Schedule the installation of concrete topping Work in order to provide concrete topping on top of equipment pads, within horizontal pipe chases and similar locations where installation of equipment, piping and similar items would cause concrete topping installation difficulties, before such equipment, piping and similar items which would preclude later installation of concrete topping have been installed.
2. Provide all temporary heat and shelters as may be required to schedule the installation of concrete topping Work at no additional expense to OWNER.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Chemical Resistant Concrete Topping: Provide the following chemical resistant topping all individual components of which shall be capable of and recommended by the manufacturer for immersion in the reagent specified for one year without loss of specified properties or color.

1. Acid Etch: Provide manufacturer's recommended acid etching compound in addition to sandblast surface preparation.
2. Bond Coat: As recommended by the manufacturer.
3. Aggregate: Acid resistant granite chips.

4. Reinforcement: Provide a glass reinforced system using materials recommended for the system and chemical resistance specified. Provide Type H glass cloth.
5. Underlayment Fill: As recommended by the manufacturer.
6. Binder: Troweled vinyl ester composition flooring.
7. Top Coats: Non-slip with complete selection of manufacturer's top coats for maximum chemical resistant.
8. Termination Strips: White metal, tapered bar type as recommended by the manufacturer.
9. Physical Properties: The complete installation when thoroughly cured shall have the following physical properties:
 - a. Tensile Strength, ASTM D 638: 13,000 pounds per square inch minimum.
 - b. Indentation, MIL-D-3134F, PAR. 4.7.3:0.062 inches maximum.
 - c. Bond Strength, ASTM C 321: 300 pounds per square inch minimum.
 - d. Flame Spread, ASTM D 635: Self-extinguishing.
 - e. Thermal Coefficient of Linear Expansion, ASTM C 531: 7.2 by 10 inches per inch per °F maximum.
 - f. Abrasive Resistance, ASTM C 501: 27 wear index.
 - g. Flexural Strength, ASTM C 580: 22,000 pounds per square inch minimum.
 - h. Compressive Strength, ASTM C 109: 16,000 pounds per square inch minimum.
 - i. Surface Hardness, ASTM D 2240: Scale "D" 77.
 - j. Water Absorption, MIL-D-3134, 4.78:0.12.
 - k. Chemical Resistance, ASTM D 1308:

<u>Reagent</u>	<u>Film Integrity</u>
50% Sodium Hydroxide	Unaffected
93% Sulfuric Acid (Spills Only)	Unaffected
35% Hydrogen Peroxide (Spills Only)	Unaffected

10. Color: Provide manufacturer's standard color Dark Grey 852.
11. Texture: Non-slip surface.
12. Product and Manufacturer: Provide one of the following:
 - a. Ceilcrete 6650 Vinyl Ester Flooring by the Ceilcote Company.
 - b. DR3116 Vinyl Ester Trafficote #16 by General Polymers Corporation.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR (and/or his installer) shall examine the areas and conditions under which concrete toppings are to be placed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Subfloor shall have a wood float finish. Concrete shall have cured for 28 days prior to initiation of this Work.

3.2 PREPARATION

- A. Subfloors: Prior to start of applying flooring, broom clean or vacuum surfaces to be covered and inspect the subfloor. Start of application operations will indicate acceptance of subfloor conditions and full responsibility for the completed Work.
- B. Sandblasting and Acid Etching: All areas to receive the Work of this Section shall be given a medium sandblast finish to insure maximum topping adhesion followed by concrete toppings manufacturer's recommended acid etching treatment.

- C. Primer: Apply primer as recommended by flooring manufacturer, prior to application of the base coat. Apply in accordance with manufacturer's directions.
- D. Fill or grind concrete substrate as may be required to achieve a smooth uniform, level finished appearance on finished Work.

3.3 APPLICATION

- A. Do not power trowel the heavy duty concrete topping unless manufacturer provides written certification to ENGINEER that material shall experience no loss in compressive strength or tensile strength.
- B. Apply termination and expansion joint strips at the junction of the flooring with other materials and at expansion joints as recommended by the manufacturer.
- C. Apply flooring only after finishing operations have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by manufacturer.
- D. Mix materials and apply bonding coat in accordance with manufacturer's instructions.
- E. Apply glass reinforcement as specified.
- F. Apply grout coats to smooth body coat.
- G. Apply vinyl ester floor topping coat to 1/4-inch dry cured minimum thickness, or greater if specifically recommended to achieve the physical properties, chemical resistances and dimensional tolerances specified.
- H. Power sand to remove trowel marks.
- I. Apply top coat sealer material for maximum chemical resistance and cleanability as recommended by the manufacturers.

3.4 ADJUSTMENT AND CLEANING

- A. Finishing: Apply a final top coat, to match the texture of the approved samples.
- B. Protect installed flooring from damage, by use of heavy Kraft paper or other covering so that flooring is without damage, or unusual or accelerated wear at time of Final Acceptance.

- C. Flooring damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to ENGINEER.
- D. The flooring at the time of Final Acceptance shall be clean and without damage, other than for normal wear associated with normal foot traffic, according to the manufacturer's published literature.

END OF SECTION 09880

SECTION 09900 PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation, priming and coats of paint specified in addition to shop priming and surface treatment specified under other sections of the Work.

1.2 GENERAL

- A. The term "paint" as used herein means all coating systems materials, which includes pretreatments, primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- B. Paint all exposed surfaces whether or not colors are designated in any schedule, except where the natural finish of the material is specifically noted as a surface not to be painted. The term "exposed" as used herein means all items not covered with cement plaster or concrete. Conduits and other materials with corrosion resistant surfaces which are in chases, above finished ceilings, or other inaccessible areas shall not require field painting. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.
- C. Structural and miscellaneous metals covered with concrete, shall only receive a primer compatible with the covering material.
- D. Pipe markers and label shall be provided in accordance with OSHA standards.

1.3 COORDINATION

- 1. Review installation procedures under other Sections and coordinate the installation of items that must be field painted in this Section.
- 2. Coordinate the painting of areas that are inaccessible once equipment has been installed.
- 3. Provide finish coats which are compatible with the prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. CONTRACTOR shall be responsible for the compatibility of all shop primed and field painted items. Furnish information on the characteristics of the

finish materials proposed to use, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the ENGINEER in writing of anticipated problems using the coating systems as specified with substrates primed by others.

1.4 PAINTING NOT INCLUDED

A. The following categories of Work are not included as part of the field-applied finish Work, or are included in other Sections of these Specifications or in other contracts.

1. Shop Priming: Unless otherwise specified, shop priming of structural metal, miscellaneous metal fabrications, other metal items and such fabricated components as shop-fabricated or factory-built heating and ventilating, instrumentation and electrical equipment or accessories shall conform to applicable requirements of Section 09900 but is included under the appropriate Sections of this Specification.
2. Pre-Finished Items: Do not include painting when factory finishing such as baked-on enamel, ceramic glazes, ceramic porcelain, polyvinylidene fluoride, plastic laminate or other similar finish is specified.
3. CONTRACTOR shall be required to touch up factory painted items with paint supplied by the item manufacturer. CONTRACTOR shall field paint damaged prefinished items as directed by ENGINEER.
4. Metal surfaces of anodized aluminum, stainless steel, chromium plate, bronze, copper, and similar finished materials will not require finish painting, unless shown or specified.
5. Operating Parts and Labels:
 - a. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts do not require finish painting unless otherwise specified.
 - b. Do not paint over any code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 - c. Remove all paint, coating or splatter inadvertently placed on these surfaces.
6. Cast-in-place concrete floor slabs.
7. Cast-in-place concrete walls and ceilings.

8. Sealants.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Submit the name and experience record of the painting applicator. Include a list of utility or industrial installations painted, responsible officials, architects, or engineers concerned with the project and the approximate contract price.
2. Painting applicators whose submissions indicate that they have not had the experience required to perform the Work will not be approved.

B. Source Quality Control: Obtain all materials from the same manufacturer unless otherwise approved. Obtain materials only from manufacturers who will:

1. Provide the services of a qualified manufacturer's representative at the project site at the commencement of Work to advise on materials, installation and finishing techniques.
2. Certify long term compatibility of all coatings with all substrates.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. ANSI A13.1, Scheme for the Identification of Piping Systems.
2. OSHA 1910.144, Safety Color Code for Marking Physical Hazards.
3. SSPC Volume 2, Systems and Specifications, Surface Preparation Guide and Paint Application Specifications.
4. State of Rhode Island, Department of Public Health.
5. ANSI/NFS Standard 60, Drinking Water Treatment Chemicals Health Effects.
6. ANSI/NFS Standard 61, Drinking Water System Components - Health Effects.

D. Requirements of Regulatory Agencies: Coatings for surfaces in contact with potable water or water being treated for potable use shall not impart any taste or odor to the water or result in any organic or inorganic content in excess of the maximum contaminant level established by applicable laws or regulations. All such coatings shall be approved by the applicable regulatory agency. Revise painting systems

specified herein to provide manufacturer's regulatory agency approved coating systems at no additional cost to the OWNER.

1.6 SUBMITTALS

A. Samples: Submit for approval the following:

1. Pipe Markers: Each type of marker specified.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.
2. Copies of proposed protection procedures in each area of the Work.
3. Copies of manufacturer's Product profile sheets.
4. List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.
5. Copies of manufacturer's complete color charts for each coating system.
6. Pipe Markers: Copies of manufacturer's technical brochure, including color chart and list of standard markers.
7. Maintenance Manual: Upon completion of the Work, furnish copies of a detailed maintenance manual including the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.

C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information.
 - 1. Name or title of material.
 - 2. Manufacturer's stock number and date of manufacture.
 - 3. Manufacturer's name.
 - 4. Contents by volume, for major pigment and vehicle constituents.
 - 5. Thinning instructions where recommended.
 - 6. Application instructions.
 - 7. Color name and number.
- B. Storage of Materials:
 - 1. Store only acceptable project materials on project site.
 - 2. Store in a suitable location approved by the ENGINEER. Keep area clean and accessible.
 - 3. Restrict storage to paint materials and related equipment.
 - 4. Comply with health and fire regulations including the Occupational Safety and Health Act of 1970.
- C. Handling of Materials:
 - 1. Handle materials carefully to prevent inclusion of foreign materials.
 - 2. Do not open containers or mix components until necessary preparatory Work has been completed and application Work will start immediately.

1.8 JOB CONDITIONS

- A. Existing Conditions:

1. Before painting is started in any area, it shall be broom cleaned and excessive dust shall be removed.
2. After painting operations begin in a given area, broom cleaning will not be allowed; cleaning shall then be done only with commercial vacuum cleaning equipment.

B. Environmental Requirements:

1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55° F and 90° F unless otherwise permitted by the paint manufacturer's printed instructions.
2. Apply other paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 65° F and 95° F, unless otherwise permitted by the paint manufacturer's printed instructions.
3. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces.
4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.
5. Adequate illumination and ventilation shall be provided in all areas where painting operations are in progress.
6. Install piping markers only after all painting and finish Work has been completed.

C. Protection:

1. Cover or otherwise protect finished Work of other trades and surfaces not being painted concurrently or not to be painted.
2. Comply with governing code requirements for air quality and material disposal regulations.
3. Provide fire extinguishers and post caution signs warning against smoking and open flame when working with flammable materials.
4. Submit protection procedures to be employed to the ENGINEER.

PART 2 PRODUCTS

2.1 MATERIAL QUALITY

- A. Manufacturer: Provide products manufactured by one of the following:
 - 1. Tnemec Company, Incorporated.
 - 2. Koppers, Incorporated.
- B. Provide the best grade of the various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.
- C. Provide primers produced by the same manufacturer as the finish coats. Use only thinners recommended by the paint manufacturer, and use only to recommended limits.
- D. Provide paints, of durable and washable quality. Use materials which will withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining, or other damage.

2.2 SUBSTITUTIONS

- A. No substitutions shall be considered that decrease the film thickness, the number of coats, the surface preparation or the generic type of coating specified. Approved manufacturers must furnish the same color selection as the manufacturers specified, including accent colors in all coating systems.

2.3 COLORS AND FINISHES

- A. Surface treatments, and finishes, are shown under "Painting Systems" below. All substrates scheduled under "Painting Systems" shall be painted whether or not shown on the Drawings, or in Schedules, unless an item is specifically scheduled as not requiring the painting system scheduled below.
- B. Color Selection: A maximum of 10 different colors shall be selected for the project.
- C. After approval of submittals and prior to beginning Work, will furnish color schedules for surfaces to be painted listed in the painting systems below.
- D. Pipe and Sign Color Coding: In general, and unless otherwise specified, all color coding of piping, ducts and equipment shall comply with applicable standards of ANSI A13.1 and OSHA 1910.144.

- E. Use representative colors when preparing samples for CONTRACTOR'S review.
- F. Color Pigments: Pure, nonfading, applicable types to suit the substrates and service indicated.
 - 1. Lead: Lead content shall not exceed amount permitted by federal, state and local government laws and regulations.
 - 2. Paints specified for application in contact with potable water shall be approved by the Rhode Island Department of Health.
- G. Submit proposed application techniques to the ENGINEER. Submit proof of acceptability, of technique proposed, by the paint manufacturer selected.

2.4 PAINTING SYSTEMS

- A. Concrete Block Walls; Interior, non-immersion:
 - 1. Surface Preparation: Remove grease, oil and all foreign matter as specified in 3.2.B.
 - 2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Primer: 54-660 Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
- B. Ferrous Metals including all Structural Steel, Miscellaneous Ferrous Metals, and all Ferrous Piping; Interior, non-immersion:
 - 1. Surface Preparation: SSPC-SP 6 Commercial Blast Cleaning as specified in 3.2.C.
 - 2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Shop Primer: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.

- 2) Field Primer or Field Touchup: 66-1211 Epoxy - 1 coat, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon.
- 3) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.

C. Ferrous Metals, Interior and Exterior, immersion:

1. Surface Preparation: SSPC-SP10 Near-White Blast
2. Product and Manufacturer: Provide the following:
 - a. Koppers:
 - 1) Primer: Kop-Coat 340 Gold - 1 coat 4.0 - 6.0 dry mils.
 - 2) Finish: Super Hi-Guard 891 - 2 coats 4.0 - 6.0 dry mils.

D. Ferrous, Non-Ferrous Metals, Fiberglass and Galvanized Metals; Exterior, non-immersion:

1. Surface Preparation:
 - a. Ferrous Metals: SSPC-SP 6 Commercial Blast Cleaning as specified in 3.2.C.
 - b. Galvanized and Non-Ferrous Metal: SSPC-SP 1 Solvent Cleaning as specified in 3.2.E. and 3.2.D.
 - c. Fiberglass: Sand as specified in 3.2.F.
2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Primer:
 - a) Ferrous Metals: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.
 - b) Non-Ferrous and Galvanized: None.
 - 2) Intermediate: 66 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon.

- 3) Finish: 71 Endura-Shield - 1 coat, 1.5- 2.5 dry mils, 270-460 square feet per gallon.

E. Galvanized Metal and Non-Ferrous Metal; Interior:

1. Surface Preparation: SSPC-SP 1 Solvent Cleaning, as specified in Section 3.2.D., and 3.2.E.
2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Primer: 66 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon.

F. All Aluminum in Contact with Dissimilar Materials:

1. Surface Preparation:
 - a. Remove all foreign matter.
 - b. Pretreatment Wash Coat of Polyvinyl Butyral Resin: 1 coat, 0.3-0.5 dry mils.
2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.

G. Pipe and Duct Insulation, Cloth; Interior:

1. Surface Preparation: Remove all foreign matter as specified in 3.2.G.
2. Products and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Primer: 51-792 PVA Sealer - 1 coat, 1.0 dry mils, 400 square feet per gallon.

- 2) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.

H. PVC Piping, Fiberglass, Fiberglass Insulation Covering; Interior:

1. Surface Preparation: Sand as specified in 3.2.F.
2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.

I. Steel and Galvanized Steel Pipe; Buried Exterior:

1. Surface Preparation: SSPC-SP 10, Near-White Blast, as specified in Section 3.2.C.
2. Product and Manufacturer: Provide the following:
 - a. Tnemec:
 - 1) Shop Primer: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: Surface preparation as specified.
 - 3) Finish: 46H-413 Tneme-Tar - 2 coats, 8.0-10.0 dry mils per coat, 90-120 square feet per gallon per coat.

J. Pre-Cast Concrete; immersion:

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in 3.2.B.
2. Product and Manufacturer: Provide the following:
 - a. Koppers:
 - 1) Finish: Kop-Coat 600 - 2 coats, 2-4 dry mils per coat.

K. Cast-In-Place Concrete; Interior and Exterior, Non-Immersion:

1. Surface Preparation: Brush-off Blast
2. Products and Manufacture: Provide the following:
 - a. Koppers:
 - 1) Finish: Bitumastic 300M - 2 coats, 8 - 20 dry mils per coat.

2.5 PIPE MARKERS

A. Manufacturer: Provide products produced by one of the following:

1. W. H. Brady Company.
2. Seton Name Plate Corporation.

B. General:

1. Piping markers shall be formed from laminated plastic. All printing shall be sealed with a formed butyrate plastic film. Markers for piping up to 6-inch diameter shall be preformed to completely wrap around the pipe requiring no adhesive. Markers for pipes over 6-inch diameter shall be preformed to the contour of the pipe and attached with stainless steel spring fasteners.
2. For pipes under 3/4-inch outside diameter: Provide brass tags, 1 1/2-inch diameter, with depressed 1/4-inch high black filled letters above 1/2-inch high black filled numbers.
3. Each marker shall consist of at least 1 legend descriptive of the function of the pipe, and a directional arrow.
4. The size of lettering and marker shall conform to ANSI A13.1.
5. Location of Markers:
 - a. Adjacent to each valve and "T" connection.
 - b. At each branch and riser takeoff.
 - c. At each pipe passage through a wall, floor and ceiling.
 - d. On all horizontal and vertical pipe runs at 25-foot intervals.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which painting Work is to be performed and notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION

A. General:

- 1. Perform all preparation and cleaning procedures as specified herein and in strict accordance with the paint manufacturer's instructions for each particular substrate and atmospheric condition.
- 2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
- 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
- 4. All surfaces which were not shop painted or which were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted, as determined by ENGINEER, shall be prepared as specified below.

B. Masonry Surfaces:

- 1. Prepare surfaces of concrete block to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, with soap and water.

2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Provide the ENGINEER with suitable testing materials in order to carry out alkalinity and moisture tests.
3. Do not paint over surfaces where the moisture content exceeds 8 percent, unless otherwise permitted in the manufacturer's printed directions.
4. Concrete block surfaces that cannot be adequately cleaned by soap and water shall be acid etched.

C. Ferrous Metals:

1. Clean ferrous surfaces including structural steel and miscellaneous metal to be shop primed, of all oil, grease, dirt, mill scale and other foreign matter by commercial blast cleaning complying with SSPC-SP 6.
2. Clean ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by commercial blasting, complying with SSPC-SP 6.
3. Clean ferrous surfaces that are exposed to temperatures above 250 F or which will be buried, or that, in the opinion of the ENGINEER, have been improperly shop coated, of all oil, grease, dirt, mill scale and other foreign matter by near white blasting complying with SSPC-SP 10.
4. Treat bare and blasted or pickled clean metal with metal treatment wash coat, prior to priming only if recommended by the paint manufacturer.
5. Touch-up shop-applied prime coats which have damaged or bare areas, with primer recommended by the coating manufacturer after commercial blasting complying with SSPC-SP 6.

D. Non-Ferrous Metal Surfaces: Clean non-ferrous metal surfaces in accordance with the coating system manufacturer's instructions for the type of service, metal substrate, and application required.

E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with a non-petroleum based solvent, recommended by the coating manufacturer, complying with SSPC-SP 1.

2. Remove shop applied chromic acid treatments on galvanized surfaces to be painted. Galvanized metals which have been given a humid storage stain treatment shall be prepared for painting by sanding or by other techniques as recommended by the paint manufacturer at no additional expense to ENGINEER.
- F. PVC Piping and Fiberglass: Lightly sand and clean all surfaces to be painted.
- G. Covering on Pipe:: Clean free of oil and surface contaminants as recommended by the coating manufacturer for substrate and application required. Do not cut or damage the insulation in any way.

3.3 MATERIALS PREPARATION

A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's directions.
2. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by the manufacturer's instructions.
3. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
5. Mixing:
 - a. Mix only in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect concrete floor from splashes or spills which could stain exposed concrete or react with subsequent finish floor material.
 - b. Mix and apply paint only in containers bearing accurate product name of material being mixed, or applied.

3.4 APPLICATION

A. General:

1. Apply paint by brush, roller, air spray, or airless spray in accordance with the manufacturer's directions and recommendations of Paint Application Specifications No. 1 in SSPC Vol. 2, where applicable. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required. Use air spray and airless spray equipment recommended by the paint manufacturer for specific coating system specified. Submit a list of application methods proposed, listing paint systems and location.
2. The paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.
3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense primary accent colors. Insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
4. Surfaces not exposed to view do not require color coding but require the same coating system specified for exposed surfaces.
 - a. "Exposed to view surfaces" is defined as those areas visible when permanent or built-in fixtures convector covers, covers, covers for finned tube radiation, grilles, etc. are in place in areas scheduled to be painted.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint as specified, before final installation of equipment.
6. Paint aluminum parts in contact with dissimilar materials as specified with appropriate primer.
7. Omit field primer on metal surfaces which have been shop primed touch-up paint shop prime coats only when approved by the ENGINEER.

8. Paint the backs of access panels, and removable or hinged covers to match the exposed surfaces.

B. Heating, Ventilating, Air Conditioning and Electrical Work:

1. Heating, ventilating, and air conditioning items to be painted include, but are not limited to, the following:
 - a. Piping, pipe hangers, and supports.
 - b. Heat exchangers.
 - c. Tanks.
 - d. Ductwork and insulation.
 - e. Motors, mechanical equipment, and supports.
 - f. Accessory items.
2. Electrical items to be painted include, but are not limited to, the following:
 - a. Conduit and fittings.
 - b. Switchgear, panels, junction boxes, motor control centers, motors and accessories.

C. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate, and provide total dry film thickness as specified.
2. Apply extra coat if required to obtain specified total dry film thickness.

D. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or

feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- E. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
- G. Transparent (Clear) Finishes:
 - 1. On exposed to view portions, use multiple coats to produce glass- smooth surface film continuity of even matt luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 - 2. Provide satin finish for final coats, unless otherwise indicated.
- H. Brush Application:
 - 1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.
 - 2. Brush apply all primer or first coats, unless otherwise permitted to use mechanical applicators.
- I. Mechanical Applicators:
 - 1. Use mechanical methods for paint application when permitted by governing ordinances, paint manufacturer, and approved by the ENGINEER. If permitted, limit to only those surfaces impracticable for brush applications.
 - 2. Limit roller applications, if approved by the CONTRACTOR, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
 - 3. Confine spray application to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and to other surfaces specifically recommended by paint manufacturer.

4. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.
- J. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by CONTRACTOR.
- K. Piping Markers: Apply piping markers in accordance with the manufacturer's written instructions in locations herein specified.

3.5 PROTECTION

- A. Protect work of other trades, whether to be painted or not, from the Work of this Section. Leave all such work undamaged. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to the ENGINEER.
- B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this Contract and other contracts after completion of painting operations.

3.6 CLEAN-UP

- A. During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
- B. Upon completion of painting Work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by the ENGINEER.

END OF SECTION 09900

SECTION 10200 LOUVERS AND VENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install all louvers and vent Work.

1. The types of louvers and vent Work required includes, but is not necessarily limited to, the following:
 - a. 6-inch dual combination drainable blade-motor operable louvers.
 - b. Sill extensions, bird screens, and other miscellaneous trim, fasteners, insulated blank-off panels and other accessories.
 - c. Full strength custom color polyvinylidene fluoride coating system.

1.2 COORDINATION

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the louvers and vent Work.
2. Coordinate louver selections with Section 15970, Automatic Temperature Controls.

1.3 RELATED SECTIONS

1. Section 15970, Automatic Temperature Controls.
2. Division 16, electrical.

1.4 QUALITY ASSURANCE

- A. Design Criteria: Comply with Sheet Metal and Air Conditioning Contractor's National Association, Architectural Sheet Metal Manual, recommendations for fabrication, construction details, and installation procedures, except as otherwise shown or specified.
- B. Source Quality Control: Verify size, location and placement of louver units prior to fabrication, wherever possible. Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing,

mechanical joints and field assembly of units. Preassemble units in as large sections as practicable.

C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM B 117, Salt Spray (Fog) Testing.
2. ASTM D 523, Specular Gloss.
3. ASTM D 659, Evaluating Degree of Resistance to Chalking of Exterior Paints.
4. ASTM 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
5. ASTM D 1737, Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus.
6. ASTM D 2244, Color Differences of Opaque Materials.
7. ASTM D 2247, Coated Metal Specimens at 100 Percent Relative Humidity.

1.5 SUBMITTALS

A. Samples: Submit for approval the following:

1. 12-inch by 12-inch corner section of each louver specified with specified finish.
2. CONTRACTOR's review will be for color, general appearance and workmanship only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and erection of louver and vent assemblies. Include details of sections and connections. Show anchorage and accessory items.
2. Copies of manufacturer's technical data including free area, air infiltration, anchor details and installation instructions including finishing products.
3. Manufacturer's written guarantees as specified.

1.6 GUARANTEE

- A. Provide written guarantee agreeing to replace louver and vent Work which fail in materials or workmanship within 3 years of the date of Final acceptance. Failure of materials or workmanship shall include, but is not limited to excessive leakage or air infiltration, excessive deflections, deterioration of finish or metal in excess of normal weathering, and defects in accessories, weatherstripping, and other components of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B 209, 5005 with temper as required for forming, or as otherwise recommended by the metal producer to provide the required finish.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T52.
- C. Fastenings: Use same materials as items fabricated. Provide types, gages and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise specified. Use continuous aluminum closure angles on the inside perimeter frame of all louver and vent Work, finished to match louvers and vents.
- D. Anchors and Inserts: Use stainless expansion bolt devices for drilled-in place anchors.
- E. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
- F. Insulated Blank-Off Panels: Provide 2-inch thick, 0.032-inch aluminum sheet with Copper Metallic polyvinylidene fluoride finish. Provide stainless steel fasteners, 12 inches on centers with closed cell polyvinylchloride compression gaskets around entire perimeter of each blank-off panel.

2.2 DUAL COMBINATION LOUVERS

- A. Furnish 6-inch electrically operable dual drainable blade dual combination louvers at all locations where operable louvers are shown. Furnish manufacturer's recommended bearings and operating mechanisms to suit the louver sizes and method of operation.
- B. Air Leakage: Do not exceed 3.5 cubic foot per minute per square foot at a static pressure of 0.5-inch of water gage.

- C. Provide all drainable operable blades 0.125-inch thick pivoted with two reinforcing bosses and 1/2-inch diameter zamac alloy pinions operating in self-lubricating nylon bearings. Drainable fixed blades shall be 0.081-inches thick with front lip gutter and recessed second gutter, both of which direct water to jamb and mullion drains. Mullions shall be of the sliding interlock type with integral drainage profile. All louver blades shall have vinyl gaskets on all edges and shall be operated by drive arms at each jamb and assembled with aluminum shoulder rivets. Head, sill and jambs shall be one piece structural members with integral calking strips and retaining beads.
- D. Provide closed cell polyvinylchloride compression gaskets between bottom of mullion and jamb and top of sill to insure leak tight connections.
- E. Provide head, sill, and jamb of one piece structural member with integral calking strips and retaining beads.
- F. Provide louver supports designed to carry 30 pounds per square foot wind load.
- G. Product and Manufacturer: Provide one of the following:
 - 1. No. 6967 model D0C6 by Air Stream Products Division, Penn Ventilator Co., Inc., by Construction Specialties, Incorporated.
 - 2. Or equal.

2.3 FINISHES

- A. Exposed Aluminum Polyvinylidene Fluoride Based Coating: Apply full strength polyvinylidene fluoride based coatings at the factory by coil coating for sheet material and spray coating for extruded material. Provide the following three coat system complying with the following:
 - 1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride based finish.
 - 2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.
 - 3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 - 0.4 mils.

4. Apply color coat over the primer by roller coating for coil material and airless or Ransburg Elastostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440 F for a dry film thickness of 0.7 mils for coil coating and 1.2 mils for spray coating.
5. Apply clear fluoropolymer topcoat to provide a dry film thickness of 0.4 - 0.8 mils. The entire three coat system shall have a dry film thickness of 1.6 mils minimum.
6. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to CONTRACTOR:
 - a. Weathering, ASTM D 659: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - b. Color Change, ASTM D 2244: No grater than 5 N.B.S. units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - c. Humidity Resistance, ASTM D 2247; few scattered blisters no larger than ASTM No. 4, after 1000 hours.
 - d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16 inch creep from areas scribed to bare metal after 500 hours.
 - e. Dry Adhesion: No pick-off when tape tested over 1/16 inch cross hatch.
 - f. Wet Adhesion: No pick-off when tape tested over 1/16 inch cross hatch; extruded material only.
 - g. Boil Water Adhesion: No pick-off when tape tested over cross hatch area after 1 hour immersion in distilled boiling water.
 - h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water 80 ± 10 F after 500 hours.
 - i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67 minimum.
 - j. Gloss, ASTM D 523: 30 ± 5 reflectivity at 60F.

- k. Pencil Hardness: HB-H minimum
- l. Dry Film Thickness: Primer, 0.2 - 0.4 mils, polyvinylidene fluoride color coating, 0.7 - 1.5 mils; clear top coat, 0.4 - 0.8 mils.
- m. Solvent Resistance: 100 Double MEK rubs minimum.
- n. Flexibility, ASTM D 1737: No cracking prior to metal fracture.
- o. Acid Resistance, ASTM D 1308: 16 hour spot test with 5% hydrochloric acid - no effect.
- p. Alkali Resistance, ASTM D 1308: 16 hour spot test with 5% sodium hydroxide - no effect.
- q. Provide the following colors:
 - 1. Operable Louvers, Sill Extension and Continuous Closure Angles:
All Components: Light bronze DF-02
 - 2. Exposed Fasteners: Color and finish to match substrate

2.5 LOUVER SCREENS

- A. Provide removable screens on the interior side of all louvers.
- B. Fabricate screen frames of the same metal and finish as the louver units to which secured. Provide frames consisting of extra heavy duty extruded 0.090-inch aluminum for permanently securing screen mesh. Frames shall be rewirable.
- C. Use bird screen of 1/2-inch mesh, 0.063-inch diameter stainless steel intercrimp wire.
- D. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on centers.
- E. Provide minimum No. 8 stainless steel metal screws unless larger screws are required by screen size.

2.6 SILL EXTENSION

- A. Gage and Finish: Same as louver.

PART 3 EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which louvers and vent Work and associated items are to be installed and notify OWNER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to OWNER.

3.2 PREPARATION

- a. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

- A. Locate and place louver units plumb, level and in proper alignment with adjacent work.
- B. Use stainless steel expansion bolt anchors with stainless steel washers and neoprene gaskets. Use spring clips at all anchors to stop deflection of the louver frame. Provide anchors spaced 2 feet-0 inches on centers. Provide continuous aluminum angles for anchoring all operable louvers.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as shown.
- D. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes and prime coats of paint so that there is no evidence of corrective Work. Return items which cannot be refinished in the field to the shop, make the required alterations, and refinish the entire unit, or provide new units, as determined by CONTRACTOR.
- E. Protection-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.
- F. Provide aluminum sheet frames of same color and finish as louvers around all louver frames projecting beyond the masonry walls on the interior, and install as the Work progresses to make the installations weathertight.

3.4 FIELD QUALITY CONTROL

- A. Determine conformity of louver and vent finish to the specifications as follows:
 - 1. The manufacturer of the louver and vent shall set aside and label samples of the metal from each production lot for the job. Protect samples from weather.
 - 2. Make sample louver and vent available at all times, for comparison with installed louver and vent Work as requested by CONTRACTOR, for the full time of the warranty.
 - 3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.5 ADJUSTMENT AND CLEANING

- A. Set adjustable louver blades for uniform alignment in open and closed positions.
- B. Adjust louvers so moving parts operate smoothly.
- C. Check the motor operator installation for the operable louver.

END OF SECTION 110200

SECTION 10400 IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDED

- A. Furnish and install all identification devices Work. The type of identification devices includes, but is not necessarily limited to, interior room identification signs, self-luminous exit signs, miscellaneous fasteners and supports, safety signs, and right-to-know labels and tags.

1.2 RELATED SECTIONS

- 1. Section 09900, Painting.

1.3 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible, to ensure proper fitting of the Work.
- B. Inserts and Anchorages:
 - 1. Furnish inserts and mechanical anchoring devices for the installation of identification devices and related work.
 - 2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
- C. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.4 SUBMITTALS

- A. Samples: Submit for approval samples of each color and finish of exposed materials and accessories required for identification devices. ENGINEER's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for fabrication and erection of identification devices. Include plans, elevations, and full-size graphic layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.
2. Copies of manufacturer's technical data and installation instructions for each type of device required.
3. Complete selection of specified manufacturer's standard and custom colors.
4. Plans showing location of all required exit signs with information indicating mounting position, location and substrate. Coordinate location of exit signs for non-interference with other Work as required by governing building code.

PART 2 - PRODUCTS

2.1 ROOM IDENTIFICATION SIGNS, FIRE EXTINGUISHER LOCATION SIGNS AND SAFETY SIGNS

- A. Material: Subsurfaced silk screened on transparent acrylic sheet, .015-inches thick, 1-5/8-inches by 13-inches, laminated to .125-inch thick colored background with white helvetica medium lettering, 3/4-inch size, all capitals, square edges and corners, 2-inch by 13-3/8-inch aluminum frame.
1. Room Identification Signs: Schedule of room names will be supplied by ENGINEER after award of Contract. Every interior door will receive two plaques and room names may be used to estimate quantities of letters.
 2. Product and Manufacturer: Provide one of the following:
 - a. 320 Series, SOG construction as manufactured by ASI Sign Systems, Incorporated.
 - b. ES100 as manufactured by Vomar Products, Incorporated.
 3. Safety Sign: Provide 25 signs to be used throughout the project, change background color to yellow with black lettering. Message, and location to be determined by ENGINEER. Signs shall be fiberglass or metal backed butylate, 10 inches by 14 inches.
 4. Fire Extinguisher Identification Sign: Provide one for each surface mounted fire extinguisher. Background color red with white lettering. Sign shall incorporate a directional arrow as located by ENGINEER.

5. Product and Manufacturer: Provide one of the following:

- a. Butyrate signs as manufactured by Seton Name Plate Corporation.
- b. Fiberglass signs as manufactured by W.H. Brady Company.

2.2 SELF-LUMINOUS EXIT SIGNS

- A. Provide self-luminous exit signs. Sign housing shall consist of an A42 color anodized extruded aluminum frame. The size, graphics and background color of the sign legend shall conform to all relevant code requirements. The legend shall be protected by a temper-resistant acrylic shield.
- B. Lumination for exit signs shall be provided by sealed phosphor-coated tubes containing tritium located directly behind each portion of each letter. The tritium light sources shall be housed in a single impact resistant module.
- C. Signs shall be listed by Underwriters Laboratories as being capable of providing a 10-15 year service life.
- D. Mount exit signs in locations shown. Surface mount signs above all exit doors unless otherwise shown. Provide manufacturer's standard universal mounting bracket.
- E. Product and Manufacturer: Provide one of the following:
 1. Everglo Signs by Self Powered Lighting Incorporated.
 2. Isolite Model 2040-01 Signs by Safety Light Corporation.

2.3 RIGHT-TO-KNOW LABELS AND TAGS

- A. Provide right-to-know target organ labels for each chemical storage area. Provide right-to-know tags along chemical pipelines and fill pipes as specified.
- B. Right-to-know labels for storage areas shall be provided with stick-on numbers/symbols and legends. Labels shall provide information such as chemical name and/or CAS number, fire and health hazard, reactivity, personal protection and target organ legends.
- C. Provide right-to-know tags for attaching to pipelines and fill lines. Locate tags at 25 feet maximum center to center distance within range on each side of through-wall pipe penetrations and as directed by ENGINEER. Tags shall be constructed of laminated plastic and furnished with nylon tie fasteners.

D. Quantity:

1. Right-to-know Labels: 25 labels minimum.
2. Right-to-know Tags: As required based on criteria specified and installed lengths of pipelines and fill lines.

E. Product and Manufacturer: Provide one of the following:

1. Right-to-know Labels and Style RTK-T2 Tags by Seton Name Plate Company.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates and conditions under which the devices are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install identification devices and components at the locations shown or, if not shown, as directed by ENGINEER, securely mounted with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
- B. Use stainless steel fasteners.
- C. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by ENGINEER.

END OF SECTION 10400

SECTION 11210

SOIL VAPOR EXTRACTION SYSTEM GROUNDWATER PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water discharge pumps.
- B. Pump motor.

1.2 RELATED SECTIONS

- A. Section 02671 A & B - Soil Vapor Extraction and Groundwater Extraction Well Modification Extraction Wells.
- B. Section 15060 - Soil Vapor Extraction Piping and Appurtenances.
- C. Section 15260 - Piping Insulation.
- D. Section 15980 - Functional Description and Instrumentation
- E. Section 16111 - Conduit.

1.3 REFERENCES

- A. NEMA MG-1 - Motors and Generators.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum).
- C. UL 778 - Motor Operated Water Pumps.

1.4 SYSTEM DESCRIPTION

- A. Provide two (2) electric motor driven progressive cavity, wobble stator, horizontal pumps with electric controllers for discharge of groundwater from water extraction tank to equalization tank # 2. Pumps shall be designated as "Duty" and "Back-Up".

1.5 SUBMITTALS

- A. Submit under provisions of Section 1E4.
- B. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.
- C. Product Data: Provide manufacturers literature including general assembly, and operation and maintenance.
- D. Manufacturer's Installation Instruction: Indicate support details, connection requirements, and include start-up instructions for pump system.
- E. Manufacturer's Certificate: Certify that pumps meet or exceed specified requirements at specified operating conditions.
- F. Field Reports: Indicate summary of hydrostatic test and field acceptance tests performed.
- G. Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, wiring diagrams and service connections for pumps, drivers, and controllers.
- H. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

1.6 QUALITY ASSURANCE

- A. Equipment and Components: Bear UL label or marking.
- B. Maintain 1 copy of each document on site.

1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, store, protect and handle products to site under provisions of SectionS 1G9 and 1G17. 01600..10

- B. Accept pumps and components on site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.
- C. Protect pumps and components from physical damage including effects of weather, water, and construction debris.
- D. Provide temporary inlet and outlet caps, and maintain in place until installation.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of pump, driver, and controller for 1 year from date of Substantial Completion.

1.10 SPARE PARTS

- A. Provide 1 set of seals, stator and rotor for each pump type and model supplied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Robbins & Myers, Inc., Springfield, Ohio, Product: Progressive County Pumps

2.2 PUMPS

- A. Type: Progressive Cavity
- B. Casting: Cast iron with NPT female suction and discharge.
- C. Stator: Viton.
- D. Rotor: Solid 416 S.S, chrome plated.
- E. Mechanical Seal: Abrasion resistant type - carbon rotating against a stationary ceramic seat viton fitted, 275 degrees F (135 degrees C) maximum continuous operating temperature.
- F. Baseplate: ASTM A-36 Steel; 10 inch C Channel

G. Performance:

1. Pump Performance Curve attached - Model 356 operating at 1200 RPM.
2. Calculated Pump Operating Flow Rates (Excludes Affects of VE7 Groundwater Extraction Well):

	Q(gpm)	ΔP (psi)	DP(psig)
Duty (1 pump)	15-1/2	19	5
Duty & Backup (2 pumps)	31	24	10

Fluid based on H₂O @ 60°F

Density = 62.37 lb/ft³

Kinematic Viscosity = 1.217×10^{-5} ft²/sec

ΔP = Differential Pressure

DP = Discharge Pressure

H. Model: 35601 Moyno SP

2.3 ELECTRIC MOTOR DRIVE

- A. Motor: 1 hp (0.75 kW), 440 volt, 3 phase, 60 Hz, 1.25 service factor, 1200 RPM, Explosion Proof for Class I, Division 2 Hazardous Environments. Refer to Section 16482.
- B. Drive: Pumps shall be long coupled and mounted to steel channel base plate complete with coupling guard by manufacturer or a qualified representative/distributor.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Decrease from line size, if required, with long radius, eccentric reducing elbows. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide

supports under elbows on pump suction and discharge. Refer to Section 15060.

- D. Provide piping. Refer to Section 15060.
- E. Provide bypass relief valve set at 25 psig (adjustable setting). Refer to Section 15060.
- F. Provide for connection to electrical service.
- G. Perform pre-operational services per manufacturer's recommendations prior to start-up.
- H. Check, align, and certify base mounted pumps by pump manufacturer or qualified representative/distributor.

3.2 FIELD QUALITY CONTROL

- A. Perform hydrostatic flow test on entire system.
- B. Testing to be witnessed by Engineer.

END OF SECTION

SECTION 11222
TOP ENTERING MECHANICAL MIXING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install top-mounted, parallel shaft mixers, complete with motors, gears, and accessories.

1.2 GENERAL

- A. All equipment shall be furnished by a single mixer manufacturer, who shall assume responsibility for proper alignment and operation of the complete mixing unit.

B. Drawings:

1. Drawings are for purposes of guidance and to show functional features required. They do not show all components required to accomplish the desired results or all components required to interface equipment. All parts, equipment and devices necessary to meet the functional requirements shall be provided.
2. Drawings are not intended to show exact dimensions peculiar to any specific mixing equipment. The dimensions of the mixer bases, may have to be changed in order to accommodate the equipment furnished.
3. All mixers shall be designed and built for the specified service, without overheating, without excessive vibration or strain, and requiring only that degree of maintenance generally accepted as peculiar to the specific type of mixer required.

1.3 RELATED SECTIONS

- A. Section 09900, Painting.
- B. Division 16, Electrical.

1.4 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. American Gear Manufacturers Association.
 - 2. Anti-Friction Bearing Manufacturers Association.
 - 3. Occupational Safety and Health Act.
 - 4. National Electric Code.
 - 5. National Electrical Manufacturers Association.
 - 6. Institute of Electrical and Electronic Engineers.
 - 7. American National Standards Institute.
 - 8. Joint Industrial Council.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's literature, illustrations, specifications and engineering data for all equipment including:
 - a. Dimensions.
 - b. Materials.
 - c. Size.
 - d. Weight.
 - e. Torque.
 - f. Bending moment.
 - g. Critical speed.
 - h. Diameter of shaft.
 - i. Shaft rpm.
 - j. Impeller diameter.

- k. Pitch of impeller.
 - l. Distance from bottom of tank to impeller.
 - 2. Drawings showing fabrication, assembly, installation and wiring diagrams.
- B. Operation and Maintenance Manuals.
 - 1. Submit in accordance with requirements of Section 113, Operation and Maintenance Data - 3 copies.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

- A. All mixers shall be single speed, vertical type as shown and specified. They shall be specially designed, constructed and installed for the service intended and shall comply with the following design conditions:
- B. Design Conditions
 - 1. Final pH Adjustment Tank:

Location:	Interior
Use:	pH adjustment
Liquid Mixed:	Groundwater
Tank Size:	8'-0" Dia, 9'-0" Height
Flow Rate:	90-180 gpm
Liquid Level:	Constant
Temperature	Abmient
Solids	< 10 ppm
pH	10 - 5

2. Mixing units shall be designed for continuous 24-hour per day, 7 day/week operation.
3. Sound pressure levels of the equipment shall not exceed 80 dbs at any point 3 feet from the equipment.

2.2 DETAILS OF CONSTRUCTION

A. Mixers:

1. Speed Reducers:

- a. Double or triple reduction units, with fully-enclosed helical gears.
- b. Lubrication: Lifetime grease system.
- c. All gear motors shall have an AGMA Class III gear rating. Gears shall be designed and rated for an AGMA service factor of not less than 1.5.
- d. Thermal rating of the speed reducer shall exceed the design mechanical rating to eliminate the need for external coolers.
- e. Speed reducer output shaft shall be constructed and supported such that shaft deflections caused by operating loads do not cause misalignment of the bearings or of the gearing. Output shaft shall be equipped with extra heavy tapered roller bearings.
- f. All bearings shall be antifriction type, oil lubricated, except for the lower output shaft bearing which may be grease lubricated. All bearings shall have a minimum B-10 life of 100,000 hours.
- g. Housing and Baseplate: Cast iron.

2. Impeller Shaft:

- a. Material: 316 stainless steel.
- b. Removable from drive unit.
- c. Maximum operating speed shall be less than 60 percent of first lateral critical speed. Bottom steady bearings are not acceptable.
- d. Total shaft runout shall not exceed 0.125 inches per 10 feet of shaft length.
- e. Maximum impeller shaft speed shall not exceed 70 rpm.

- f. Impeller shaft shall be connected to the gear reducer output shaft by a rigid flanged coupling welded to the shaft. Coupling shall be designed to transmit any torque and withstand any bending moments which the coupling may be subject to. The unit shall be supplied with a flange-mounted lip seal for atmospheric pressure on both sides of shaft seal. The seal shall be constructed of 316 stainless steel with teflon elastomers.
- 3. Impellers:
 - a. Four (4) blade, 316 stainless steel, axial turbine type, keyed to the shaft.
 - b. Blades shall be pitched at a maximum of 45 degrees from the horizontal, and bolted to the impeller hub.
- 4. Motors:
 - a. Suitable for continuous operation, of sufficient horsepower to operate the mixer within the nameplate rating without overloading. All motors shall be built in accordance with current NEMA, IEEE and ANSI standards.
 - b. Single speed, squirrel cage induction, TEFC, NEMA Design B. motor shall be suitable for operation on a 480 volt, 60 Hz, 3 phase supply, and shall include a 1.5 service factor. Motor speed shall not exceed 1800 rpm.
 - c. Equipped with non-hygroscopic ball bearings of the extended duty type, grease or oil lubricated.
 - d. Motor frame and shields shall be cast iron or heavy fabricated steel of such design and sizes as to hold the motor components rigidly in proper position. They shall be provided with lifting lugs and stainless steel rating nameplates indicating motor characteristics.
 - e. Critical speed of the shaft and rotor assembly shall be at least 20 percent greater than maximum motor operating speed.
- 5. Product and Manufacturer:
 - a. Lightnin Mixers.
 - b. Philadelphia Mixers.

2.3 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

- A. Each mixer shall be furnished with the following:
 - 1. One set of each type of bearings used.

2.4 PAINTING

- A. Equipment shall receive manufacturer's shop primer and standard protective coating system prior to shipment. Primer shall be compatible with field painting specified herein.
- B. Machined, polished, and non-ferrous surfaces shall be coated with corrosion prevention compound.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations.
- B. All electrical connections shall be in conformance with the requirements of Division 16, Electrical.
- C. Once installation is complete, touch-up damaged paint with manufacturer supplied paint.

END OF SECTION 11222

SECTION 11300
VERTICAL SUBMERSIBLE RECOVERY WELL PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install two (2) vertical, submersible recovery well pumps.

1.2 RELATED SECTIONS

- A. 1. Section 13410, General Instrument and Control Requirements
2. Division 15, Mechanical
3. Division 16, Electrical

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:

1. Manufacturer shall have experience in producing similar equipment, and shall show evidence of similar installations in satisfactory condition and operation.

- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. Standards of the Hydraulic Institute.
2. National Electric Code.
3. Standards of National Electrical Manufacturers Assc.
4. Institute of Electric and Electronic Engineers.
5. American National Standards Institute.
6. Standards of American Water Works Association.

1.4 SUBMITTALS

A. Shop Drawings: submit for approval Shop Drawings showing the following:

1. Manufacturer's literature, illustrations, specifications, and engineering data including: dimensions, materials, size and weight, flowrate, head, brake horsepower, motor horsepower, speed, shut-off head, performance data.
2. Shop drawings showing: Fabrication, assembly, installation and schematic wiring diagrams.
3. Certified test data and curves for all pumps showing overall pump efficiencies, required net positive suction head, flow rate, head, brake horsepower, motor horsepower, speed and shutoff head.
4. Operation and Maintenance Manuals: Submit three (3) complete installation, operation and maintenance manuals including copies of all approved Shop Drawings.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

A. The well pumps shall be of the vertical submersible type. The pumps shall be designed, constructed and installed for the service intended, and shall comply with the following minimum conditions:

Design and Conditions:

Location

Production Area

Recovery Well PW-110

Flowrate:	50 gpm
Temperature:	Ambient
pH:	6.5-7.5 units
Casing Diameter:	6-inch
TDH:	90 feet
Discharge Piping Size:	4-inch
Max. Motor size:	5 Hp

Design and Conditions:

Location

Production Area

Recovery Well PW-120

Flowrate:	20 gpm
Temperature:	Ambient
pH:	6.5-7.5 units
Casing Diameter:	6-inch
TDH:	90 feet
Discharge Piping Size:	4-inch
Max. Motor size:	5 Hp

2.2 DETAILS OF CONSTRUCTION

- A. General: The vertical submersible well pumps shall conform with the following details of construction and materials. The pumps shall be designed for continuous operation under submergence, without leakage.
1. Pump impellers and check valve shall be constructed of 304 stainless steel.
 2. Bushings shall be constructed of bronze, ASTM B505 alloy 836.
 3. The suction inlet shall be belled. A sand collar constructed of rubber shall be provided to protect the suction bearings from abrasives in the liquid to be pumped.
 4. The impeller shall be enclosed and balanced. The impeller shall be securely fastened to the bowl shaft with taper collets, constructed of stainless steel, type 304.
 5. The shaft shall be constructed of high chrome stainless steel, ASTM A2176, grade 304.
 6. The pump suction shall include a stainless steel strainer. the net inlet area shall be equal to at least 5 times the impeller inlet area.
 7. The coupling shall be constructed of 416 stainless steel and keyed to the pump shaft.

B. Motors:

1. The pump motor shall be of the submersible induction type designed for continuous under-water operation. Motor shall be suitable for operation on a 480 volt, 60 Hz, 3 phase supply.
2. The motor shall be designed with normal starting torque. The motor shall have a service factor of 1.50.
3. The motor shall be oil-filled and shall incorporate a mechanical seal to restrict foreign matter from entering the motor.
4. The motor shall be equipped with a factory-installed winding protection, suitable for mounting on the stator winding. The winding protection shall be of the thermostat type, temperature sensing with normally closed contacts.
5. Pump motor cables shall be designed for submersible duty and shall be indicated by code or legend permanently applied to cable.

C. Product and manufacturer: Provide the submersible vertical well pumps as manufactured by one of the following:

1. Grundfos Pumps Corporation
2. Or equal.

2.3 PAINTING

- A. Pumps, motors, appurtenances shall receive the manufacturer's standard finish paint system prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations.

END OF SECTION 11300

SECTION 11340
SOIL VAPOR EXTRACTION (SVE) SYSTEM EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install the required vacuum blower system, dilution air manifold, vapor extraction manifold, water extraction manifold, air filters, and air purge vacuum pump system for the soil vapor extraction (SVE) system.

1.2 RELATED SECTIONS

- A. Section 02671 - Soil Vapor Extraction Well Modifications
B. Section 02672 - Groundwater Extraction Well Modifications
C. Section 11210 - Soil Vapor Extraction System Pumps
D. Section 11350 - SVE Vapor-Phase Treatment System
E. Section 13200 - SVE Shop Fabricated Tanks
F. Section 15060 - SVE Piping and Appurtenances
G. Section 15980 - SVE System Instrumentation and Controls
H. Section 09900 - Painting

1.3 REFERENCES

1.4 SYSTEM DESCRIPTION

- A. The Soil Vapor Extraction (SVE) system will use a skid-mounted packaged vacuum blower system and other components to enhance the removal of groundwater from a well. The SVE system will be comprised of the following:
- Soil vapor and groundwater extraction wells;
 - Rotary-lobe type, positive-displacement vacuum blower system;
 - Vapor extraction tank system;
 - Vapor extraction manifold;
 - Water extraction tank system;
 - Water extraction manifold;
 - Water discharge pumps;
 - Dilution air manifold;
 - Above-grade, insulated/heat traced manifold system;
 - Vapor-phase treatment system;
 - SVE control system; and
 - Equipment trailer.

- B. The SVE system extracts groundwater and soil vapor in two separate streams from each extraction well. Contaminated groundwater is hydraulically extracted through a straw in the well by applying a vacuum to the water extraction tank, while soil vapor is pneumatically extracted from unsaturated zone soils by applying vacuum directly to the well casing riser.

1.5 SUBMITTALS

- A. Submit under the provisions and requirements of Section 01300.
- B. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.
- C. Product Data: Provide manufacturer's literature, including general assembly, vacuum blower curves, showing performance characteristics with blower an system, operating point indicated, controls, wiring diagrams, and service connections.
- D. Manufacturer's Installation Instruction: Indicate support details, connection requirements, and include start-up instructions.
- E. Manufacturer's Certificate: Certify that vacuum blower, air filter, and extraction manifolds meet or exceed specified requirements at specified operating conditions.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under the provisions and requirements of Section 01730.
- B. Operation Data: Include Manufacturer's instructions, start-up data, trouble-shooting checklists for vacuum blow, air filter, and extraction manifolds.
- C. Maintenance Data: Include Manufacturer's literature, cleaning procedures, replacement parts lists, and repair data for vacuum blower system filters, valves, instruments and controls associated with the vapor and groundwater extraction manifolds.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.
- B. Installer: Company specializing in performing the work of this Section with minimum three (3) years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, store, protect and handle products to site under the provisions of Sections 01545 and 01610.
- B. Accept vacuum blower, air filter, extraction manifolds, and components on site in factory packing. Inspect for damage. Comply with Manufacturer's rigging and installation instructions.
- C. Protect vacuum blower, air filter, extraction manifolds, and components from physical damage including effects of weather, water, and construction debris.
- D. Provide temporary inlet and outlet caps, and maintain in place until installation.

PART 2 PRODUCTS

2.1 VACUUM BLOWER SYSTEM

A. General

Provide Vacuum Blower System consisting of the Vacuum Blower, Motor, V-Belt Drive and OSHA Guard, Inlet and Discharge Silencers mounted on an elevated structural steel base. Blower system shall be pre-assembled and painted by manufacturer prior to shipment to job site, complete with 6" flanged inlet and outlet fitting. In addition, provide 6" inlet and outlet flexible connectors for field installation. (See Section 15980 for Associated Instruments and Controls.)

B. Vacuum Blower

The vacuum blower shall be a gas-tight, rotary, positive displacement blower designed for continuous operation of the prescribed process conditions. Materials shall be cast iron for the case, impeller, and head plate with carbon steel shafts and alloy steel timing gears. Blower shall be equipped with heavy-duty ball bearings. Timing gears and gear-end bearings shall be splashed oil lubricated; drive end bearings shall be grease lubricated. Blower connections shall be oriented vertically.

1. Performance

- a. Nominal Rotative Speed: 2708 RPM
- b. 1,000 ICFM @ 8" HG Inlet Pressure (750 SCFM - @ standard conditions 60°F and 1 ATM)
- c. Discharge Pressure: 1 psig
- d. Brake HP @ 10.5" Hg Vacuum Relief Setting: 35.3 BHP
- e. Noise Level at 1 Meter: ≤ 95 dB

2. Manufacturer/Model No.: MD Pneumatics Blower Model 5514-81L3 Gas Tight Blower
- C. Motor: 40 HP, 1800 RPM XP suitable for Class I, Division 2 hazardous locations, continuous duty service (LC), Frame Size 324T 460/3/60 with slide base. (LC - All cast iron without thermostats).
- D. V-Belt Drive: Drive shall increase motor RPM to blower nominal rotative speed and shall be designed to transmit the motor rated horsepower with a service factor of 2.0. Drive shall be provided with a guard meeting OSHA requirements.
- E. Inlet Silencer: 6" Inlet Silencer shall be Universal Silencer Co. Model No. RISY-6.
- F. Discharge Silencer: 6" Discharge Silencer shall be Universal Silencer Co. Model No. RDY-6. Unit shall be leak tested by the manufacturer. Contractor shall be submit evidence of manufacturer's leak test for the unit provided.
- G. Blower System Base: All equipment related to the vacuum blower assembly, including the vacuum blower, motor, drive, silencers, interconnecting piping and appurtenances, shall be mounted on a rugged, structural steel skid with open frame design to minimize noise amplification.
1. Structural steel shall be designed and fabricated in accordance with applicable provisions of American Institute of Steel Construction "Specifications for Design, Fabrication, and Erection of Structural Steel Buildings." All structural steel shapes shall conform to ASTM A-36.
 2. Bolts and nuts shall be galvanized, coarse thread, hexagonal-head type conforming to ASTM A-307.
 3. The skid shall be designed for lifting the dry weight by crane with 100 percent allowance for impact.
 4. Projecting corners on skids, supports, etc. shall be rounded to prevent personnel injury.
- H. Blower System Piping
1. All piping, including supports, brackets, shoes, and clips, shall be completely fabricated, assembled, and painted on the skid in the Contractor's shop.
 2. Piping and Inlet and Outlet Flanges shall be designed, fabricated, and tested in accordance with the ANSI Code for Pressure Piping, B-31.1, latest edition.

3. All Blower System piping shall be routed for the shortest practical run and have minimum number of fittings.
4. Piping shall be designed so that the loads and moments applied at the equipment connections do not exceed the permissible loads and moments for the equipment.
5. Piping shall be supported and shall be provided with anchors, braces or vibration dampeners to prevent excessive expansion forces or vibrations from being transmitted to the equipment.
6. Piping at the blower shall be supported to allow removal of the blower without the necessity of installing temporary supports.

I. Blower System Paint

Steel piping valves and fittings shall be cleaned, primed, and painted by the manufacturer prior to shipment to the project site. The manufacturer's standard priming and topcoat painting system shall be acceptable.

J. Blower System Insulation

1. Discharge piping and silencer, if operating at temperatures above 140°F at design conditions, shall be covered with 1-inch-thick calcium silicate insulation for personnel protection.
2. Pipe covering shall be used on cylindrical surfaces. Irregular surfaces shall be covered with insulation cement, trowelled smooth to provide a uniform surface.
3. Insulation shall be covered with 0.020-inch-thick aluminum jacket and banded with 3/4-inch x 0.020-inch strap.
4. Insulation cement surfaces shall be painted with aluminum paint compatible with the cement used.

K. Blower System Inspection and Testing

1. The OWNER reserves the right to inspect all materials, subassemblies, and equipment prior to fabrication, and completed system prior to shipment. The CONTRACTOR shall advise the OWNER, in writing, of dates that equipment/material will be ready for inspection, a minimum of one week prior to that date.
2. The CONTRACTOR shall, as a minimum, perform the following mechanical and electrical tests to assure quality of workmanship and proper operation

of equipment prior to shipment. The CONTRACTOR shall advise the OWNER of his schedule for performing such tests, a minimum of one week before initiation of testing.

- a. Welded piping shall be hydrostatically pressure tested for one hour at a pressure equal to 1.5 times the design pressure of the connected equipment.
- b. Operational test of the motor circuits
- c. Operational test of the equipment
- d. Check ground system for continuity of all taps to equipment.

2.2 DILUTION AIR MANIFOLD

A. General

The Dilution Air Manifold consists of valves, fittings, piping, and an in-line filter. The Dilution Air Manifold provides for automatic and manual dilution of the VOC soil gas stream to the vapor phase treatment system as required to maintain oxidation temperatures within the prescribed range. In addition, the manifold also includes a pressure relief valve set at 10.5"HG vacuum for protection of the vapor extraction tank and vacuum blower system.

- B. 6" Butterfly Valves (Manual and Motorized), and 6" check valve - Refer to Section 15060 - SVE Piping and Appurtenances.

- C. 6" Inline Filter - Refer to Paragraph 2.5 - Air Filters

D. Vent

Provide 6" steel and weld neck fittings in accordance with Section 15060 - SVE Piping and Appurtenances, as required to construct a dilution Air Inlet Vent through the trailer roof. Vent shall include double 90°F elbows to prevent entry of rainwater. The CONTRACTOR shall submit shop drawings detailing a debris screen to prevent clogage of the Inlet Vent.

2.3 VAPOR EXTRACTION MANIFOLD

A. General

The Vapor Extraction Manifold consists of manual and motor actuated valves, fittings, gauge assemblies, and piping, as detailed by the contract drawings. The Vapor Extraction Manifold facilitates automatic application of vacuum to the extraction well casings based on extraction well pumping levels, and combines and delivers soil gas flows from the wells (6) to the Vapor Extraction Tank.

B. 3" Butterfly Valves (manual and motorized), grooved, threaded, and flanged fittings - Refer to Section 15060 - SVE Piping and Appurtenances.

C. Gauge Assemblies - Refer to Section 15980 - SVE System Instrumentation and Controls.

2.4 WATER EXTRACTION MANIFOLD

A. General

The Water Extraction Manifold consists of manual ball valves, solenoid actuated globe valves, check valves, fittings, gauge assemblies, and piping as detailed by the contract drawings. The Water Extraction Manifold facilitates automatic application of vacuum to the groundwater extraction straws in each of six (6) extraction wells and combines and delivers groundwater from the extraction wells to the Eater Extraction Tank.

B. 1" Ball Valves (Manual), 1" Solenoid Valves, 1" Check Valves, grooved, threaded, flanged, and swaged swivel fittings - Refer to Section 15060 - SVE System Piping and Appurtenances.

C. Gauge Assemblies - Refer to Section 15980 - SVE System Instrumentation and Controls.

2.5 AIR FILTERS

A. Provide two (2) 6" MNPT Inline Filters, Solberry Model No. CSL-275P-600.

B. Mount one (1) filter on the Vapor Extraction Tank 6" Outlet Flange and connect to 6" Blower Inlet Piping, utilizing 6" companion flanges.

C. Mount the second filter inline with the Dilution Air Manifold Vent line utilizing 6" companion flanges.

2.6 AIR PURGE VACUUM PUMP SYSTEM

A. General

Provide Air Purge Vacuum Pump system consisting of two (2) vacuum pumps, motor, double V-belt drive system with guard, membrane filter, solenoid valve, pressure relief valve and pressure gauge assembly. The system shall be provided directly from the distributor pre-assembled and mounted on a steel channel base plate assembly, assembled and piped for common vacuum and discharge connections. The system mounted to the trailer wall, as indicated on the contract drawings, with two (2) welded steel brackets complete with a vibration dampening system to prevent excessive vibration and noise.

B. Vacuum Pumps

Quantity of two (2) GAST Model VCD-10, oilless, reciprocating vacuum pumps.
Pump Speed: 2,000 RPM
Maximum Vacuum: 28" HG Vacuum
Rated Flow: 4.8 CFM (Free Air)n @ Open Flow Condition
(Per Unit): 0.375 CFM (Free Air) @ 25" HG Vacuum

C. Motor: 1 HP 230/460 VAC, 3 phase, 60 Hz
TEFC component complete with 5-inch pulley and belt guard

D. Membrane Filter

Genie Membrane Separator Co., Prairieville, LA, Model No. 130-002-SS complete with mounting bracket (part no. 130-509SS) and one (1) replacement membrane kit.

E. Solenoid Valve

Tag No. SV-030 - Refer to Section 15060 - SVE Piping and Appurtenances

F. Pressure Relief Valve

Tag No. PCV-044 - Refer to Section 15060 - SVE Piping and Appurtenances

G. Pressure Gauge Assembly

Tag No. PG-030 - Refer to Section 15980 - SVE System Instrumentation and Controls

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install and prepare equipment for operation in accordance with manufacturer's instructions.
- B. Provide access space around products specified in this section for service. Provide no less than minimum as recommended by manufacturer.
- C. Insulate and heat trace groundwater piping water extraction tank and lower portion of vapor extraction tank (to level of conductance sensor LE-025B).
- D. Provide for connection to electrical service.

3.2 FIELD QUALITY CONTROL

- A. Perform hydrostatic test on the entire SVE system. The test shall be witness by a professional engineer licensed in the State of Rhode Island.

END OF SECTION 11340

SECTION 11350 SVE VAPOR-PHASE TREATMENT SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Thermal/Catalytic Oxidizer

1.2 RELATED SECTIONS

- A. Section 11340 - Soil Vapor Extraction Equipment
- B. Section 13121 - SVE Trailer and Appurtenances
- C. Section 15980 - Instrumentation and Control Requirements

1.3 REFERENCES

1.4 SYSTEM DESCRIPTION

- A. As required to meet vapor-phase discharge requirements, one (1) thermal/catalytic oxidizer vapor phase treatment system will be installed to reduce the effluent contamination levels to the necessary limits. This device will be set-up to operate using natural gas and will be provided with a flame arrestor and an exhaust heat exchanger to preheat the inlet air. The unit will be designed for ready changeover from thermal oxidation (LEL 80% maximum inlet concentration) to catalytic oxidation (LEL 30% maximum inlet concentration), as the combustible vapor concentrations decrease with time. This system will be fitted with an automatic temperature-driven dilution air control system, complete with motor actuated dilution air valve (provided loose) and a high temperature shutdown/alarm. The device will meet the explosion-proof requirements of the equipment shelter. As a minimum, the combustion blower motor will be explosion-proof, and the control unit will be air purged.

1.5 SUBMITTALS

- A. Submit under provisions of Section 1E4.
- B. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.
- C. Product Data: Provide manufacturer's literature, including general assembly, controls, wiring diagrams, and service connections.

- D. Manufacturer's Installation Instruction: Indicate support details, connection requirements, and include start-up instructions.
- E. Manufacturer's Certificate: Certify that thermal/catalytic oxidizer meets or exceeds specified requirements at specified operating conditions.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Data: Include Manufacturer's instructions, start-up data, and troubleshooting checklists.
- C. Maintenance Data: Include Manufacturer's literature, cleaning procedures, replacement parts lists, and repairs data for vacuum blower, air filter, and extraction manifolds.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, store, protect and handle products to site under provisions of Section 1G9 and 1G17.
- B. Accept thermal/catalytic oxidizer and components on site in factory packing. Inspect for damage. Comply with Manufacturer's rigging and installation instructions.
- C. Protect thermal/catalytic oxidizer and components from physical damage including effects of weather, water, and construction debris.

PART 2 PRODUCTS

2.1 THERMAL/CATALYTIC OXIDIZER

- A. Unit shall be provided by the manufacturer complete with all accessories including a flame arrestor, dilution air valve (provided loose), and a heat exchanger.

- B. Skid: 60 in. x 147 in. (152.4 cm x 373.4 cm)
- C. Stack: ID of 22 in. x 23 in. (55.9 cm x 58.4 cm)
- D. Combustion Chamber: ID of 48 in. x 48 in. x 60 in. (121.9 cm x 121.9 cm x 152.4 cm)
- E. Combustion Blower Motor: 3 hp (2.2 kw)
- F. Burner: turndown ratio 20 to 1; maximum output capability 3,000,000 BTU/hour
- G. SCFM Rating: 1000 SCFM (28.3 m³/min)
- H. Calculated Operating Differential Pressure:
 Max without Catalyst = 10 in. W.C.
 Max with Catalyst = 15 in. W.C.
- I. Performance:
 - 1. Thermal Data
 - SCFM added by combustion blower when fired on ratio 383 SCFM (10.9 m³/min)
 - total ACFM @ 1400°F (760°C) 4872 ACFM (138.0 m³/min)
 - burner chamber volume required for 0.5 seconds retention time @ 1400°F (760°C) 40.6 ft³ (1.15 m³)
 - burner chamber volume required for 1.0 seconds retention time @ 1500°F (815°C) 85.6 ft³ (2.424 m³/min)
 - stack velocity
 - @ 500 SCFM (14.2m³.min) from process stream 11.6 ft/sec (3.54 m/sec)
 - @1000 SCFM (28.3m³.min) from process stream 23.1 ft/sec (7.04 m/sec)
 - estimated weight, thermal unit only 2300 lbs (1043 Kg)

2. Catalytic Data

- SCFM added by combustion blower when fired on ratio 117 SCFM (3.3 m³/min)
 - total ACFM @ 600°F (315°C) 2242 ACFM (63.5 m³/min)
 - catalyst volume for 90% plus destructive efficiency 2.0 ft³ (56,634 cm³)
 - inlet temperature 600°F (315°C)
 - maximum concentrations 25% of the LEL
 - stack velocity
@ 500 SCFM (14.2m³.min) from process stream 5.3 ft/sec (1.62 m/sec)
@1000 SCFM (28.3m³.min) from process stream 10.6 ft/sec (3.23 m/sec)
 - estimated weight, thermal unit only plus catalytic module 2640 lbs (1198 Kg)
3. Operating Pressure Unit shall be designed to withstand two (2) times the expected operating differential pressure indicated above.

J. Dilution Air Valve: Shall be 6" nominal size, wafer or flanged style butterfly valve with NEMA 7 reversing electric actuator. Materials of construction must be compatible with toluene at a concentration of 1.5% in air. Other specifications may apply as determined by the Thermal/Catalytic Oxidizer System manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around thermal/catalytic oxidizer for service. Provide no less than minimum as recommended by manufacturer.
- C. Insulate piping associated with thermal/catalytic oxidizer. Refer to Section 15260.
- D. Provide for connection to electrical service. Refer to Section 16111.

- E. Unit shall be set on existing pavement and leveled as indicated on the contract drawings.

3.2 FIELD QUALITY CONTROL

- A. Perform flow test on entire system.
- B. Require test to be witnessed by Engineer.

END OF SECTION

SECTION 11351
HORIZONTAL CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install horizontal pumps baseplate mounted complete and operational with motors, coupling, coupling guard, and shaft seal.

1.2 RELATED SECTIONS

- 1. Sections 15080, Piping, Smaller Than 4 Inches Diameter
- 2. Division 16, Electrical.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with all applicable provisions and recommendations of the following, except as otherwise shown or specified.

- 1. Standards of the Hydraulic Institute.
- 2. National Electric Code.
- 3. Standards of National Electrical Manufacturers Association.
- 4. American National Standards Institute.
- 5. Standards of American Water Work Association.

- B. Shop Tests:

- 1. Pump casings shall be hydrostatically tested to twice the discharge head or 1-1/2 times the shutoff head, whichever is greater.

1.4 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:

- 1. Manufacturer's literature, illustrations, specifications and engineering data include: dimensions, materials, size, weight, performance data and curves

showing overall pump efficiencies, flow rate, head, brake horsepower, motor horsepower, speed and shut-off head.

2. Shop Drawings Showing: Fabrication, assembly, and installation information.
3. Operation and Maintenance Manuals Including: Complete installation, operation, and maintenance data including. Recommended spare parts list for all components.
4. Pump test data.
5. Motor tests and data.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

- A. The pumps shall be specifically designed and constructed for the service intended and shall comply with the following minimum conditions:

Design Conditions	Pump Name	
	Equalization Tank Transfer Pump	Backwash Tank Transfer Pump
1. No. Required:	2	2
2. Service Conditions:		
Flow Rate (GPM)	100	100
TDH (ft)	112	112
Suction Lift	Flooded	Flooded
SG	1.05	1.05
pH Range	7-8	7-8
Temperature	Ambient	Ambient
Wetted materials of construction	Ductile Iron	Ductile Iron

2.2 DETAILS OF CONSTRUCTION

A. Construction: All pumps shall be designed for continuous operation, 24 hours/day, 7 days per week without damage. The pumps shall conform to ANSI process pump design standards.

1. All non-wetted parts shall be mild steel, cast iron, or ductile iron per manufacturers standards.
2. Stuffing box seal shall be double mechanical seal design providing drip-tight operation and requiring no external lubrication.
3. Bearings shall be extra heavy duty type designed to provide less than 0.001 inch end play. Boring shall be oil lubricated.

B. Pump Drive:

1. Suitable for continuous operation with sufficient horsepower to cover the entire selected impeller curve.
2. Motors shall be built in accordance with current NEMA, IEEE, and NASI standards for single speed, squirrel cage induction motors.
3. Motors shall be TEFC type, wound for 3 phase, 60 Hz, 480V service with a 1.5 service factor. Motor speed shall not exceed 1800 RPM.
4. Motors shall be equipped with oil or grease lubricated, extended duty non-hygroscopic ball bearings.
5. Motor shall include a permanently attached stainless steel nameplate showing all motor characteristics.

C. Self-Priming Pumps:

1. Pumps listed as self-priming or as having a suction lift will include an efficient self-priming casing.
2. Self-priming casings shall be of the same materials of construction as other wetted parts.
3. Self-priming casing shall be an integral part of pump casing. Remotely mounted chambers are not acceptable.

2.3 PAINTING

- A. Pumps, motors, drives, frames, baseplates, appurtenances, etc., shall receive manufacturer's standard finish paint system prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations.
- B. Support piping independent of pumps.

3.2 START-UP AND TESTING

- A. CONTRACTOR shall verify that structures, pipes and equipment are compatible.
- B. Make adjustments as required, to place system in proper operating condition.

END OF SECTION 11351

SECTION 11373
OIL/WATER SEPARATOR

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install one (1) slant rib coalescing oil/water separator complete with coalescing media, inlet chamber, oil collection chamber, sludge collection chamber, effluent chamber, covers and hatches, supporting platform, ladder, walkway with railing, and all required connectors and appurtenances.

1.2 REFERENCE STANDARDS

- A. AWS D1.1, Structural Welding Code.
- B. ASTM A 36, Structural Steel.
- C. National Electric Code.
- D. Standards of National Electrical Manufacturers Association.
- E. Institute of Electrical and Electronic Engineers.
- F. American National Standards Institute.
- G. Standards of American Water Works Association.
- H. American Institute of Steel Construction.
- I. API B-1630, American Petroleum Institute.

1.3 DESIGN REQUIREMENTS

- A. The oil/water separator shall be designed, constructed and installed for the service intended, and shall comply with the following design conditions:

1. Design Conditions

Location:	Indoors
Room Temperature:	60°F
Use:	Oil/Water Separation
Flow Rate:	0 to 30 gpm
Flow Characteristics:	Normally continuous (occasionally intermittent)
Wastewater Temperature:	50° to 75° F
Influent pH:	6.0 to 8.5 units

2. Performance Requirements

The separator shall be capable of removing all free-floating product from the SVE system groundwater. The separator must produce an effluent containing no more than 10 mg/L of free-product 20 microns or larger. The separator must provide a sludge and free-product collection chamber for the removal of solids from the flow stream without plugging the coalescing media packs.

The separator shall be capable of handling variable flow rates ranging from 0 (zero) gpm (no flow conditions) to 30 gpm on a continuous as well as intermittent basis without affecting the performance outlined above. The separator tank must be elevated as shown to facilitate gravity discharge of the effluent, sludge and free-product.

1.4 SUBMITTALS

A. Shop Drawings:

1. Submit for approval Shop Drawings showing the following:

- a. Manufacturer's literature, illustrations, specifications, and engineering data including: dimensions, materials, size, and weight.
- b. Fabrication, assembly, installation and wiring diagrams.
- c. Provide setting drawings, templates and directions for the installation of the supporting platform, ladder, walkway with railing, anchor bolts, and other anchorages.
- d. Names of contacts, telephone numbers, and brief descriptions for three (3) similar installations.

B. Operation and Maintenance Manual:

1. Submit five (5) complete installation, operation and maintenance manuals including copies of all approved Shop Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer shall have experience in producing similar equipment, and shall show evidence of similar installations in satisfactory condition and operation.

2.2 OIL/WATER SEPARATOR

A. Separator Tank:

1. All tank, covers, baffles, external structural members, supports, and all associated equipment shall be constructed of type 304 stainless steel conforming to ASTM A-36, with a minimum thickness of 1/4 inch, with the tank bottom plates having a minimum thickness of 3/8 inch.
2. All gaskets shall be constructed of EPDM.
3. All weldments shall be designed and performed in strict conformance with AWS standards. Continuous welds shall be used for all seal welds and structural support welds. Intermittent welding shall be permitted for stiffener welds. All continuous seal welds are to be visually examined and dye-penetrant tested in the shop.
4. The separator shall be shop fabricated, pre-piped, pre-wired, and ready for installation on the supporting platform for achieving the desired elevation.
5. The supporting structure assembly, complete with a ladder, a walkway with railings; shall be shop-fabricated, skid-mounted, and ready for installation shall be constructed of steel.
6. The separator and supporting structure shall be equipped with appropriate lifting lugs for safe and convenient lifting and transportation.

B. Inlet Chamber:

1. The inlet chamber shall be provided with a non-clogging dispersion nozzle and shall disperse the flow evenly across the width of the coalescing pack. The inlet chamber shall allow for the separation of free-product together with of heavy solids for subsequent settling into the sludge chamber.

C. Separation Chamber:

1. The separation chamber shall be provided with a standard coalescing media pack and also a dense coalescing media pack for efficient removal of free-product.
2. The coalescing media shall be constructed of type 304 stainless steel and shall be arranged in a configuration that provides a minimum of 40 sq. ft. of oil coalescing surface and 10 sq. ft. of solids settling area per cubic foot of media. The plates shall be at a maximum spacing of 3/4 inch. Coalescing plate ribs shall form a 55° settling shelves to enhance removal. Media shall be encased in a 304 stainless steel frame and shall provide easy installation and removal with lifting lugs.
3. The dense coalescing media pack shall be constructed of type 304 stainless steel. Dense coalescing media pack shall be encased in a type 304 stainless steel frame and shall provide easy installation and removal with lifting lugs.
4. The separation chamber shall be provided with a full, hinged, vapor tight cover as shown and specified.

D. Free-Product Reservoir:

1. The free-product reservoir shall be located at the end of the separation chamber. The reservoir shall have a fixed weir for automatic decant of the separated free-product.

E. Effluent Chamber:

1. The effluent chamber shall be provided with a high-level switch hard-wired for connection to a programmable logic controller. The effluent chamber shall be provided with a full, hinged, vapor tight cover for easy accessibility for viewing into the chamber.

F. Sludge Chamber:

1. The sludge chamber shall be constructed of type 304 stainless steel. The tank shell shall have a minimum thickness of 1/4 inch and the tank bottom plates shall have a minimum thickness of 3/8 inch. The sludge chamber shall be distinct, below the coalescing pack, and equipped with 45° pitched sides, baffles, three (3) sludge sampling ports, and two (2) sludge outlet ports as shown and specified.

G. Supporting Platform, Ladder, Walkway with Railing:

1. Supporting platform shall be constructed of structural angles and I-beam posts to support, anchor, and elevate the oil/water separator unit as shown and specified. All supporting structures, complete with ladder and walkway with railing shall be in accordance with OSHA regulations and painted in accordance with Section 09900 - "Painting".

H. Lubricants:

The Manufacturer shall furnish an initial supply of all lubricants and oils required to operate the equipment and a lubricant specification with the type and grade to meet the service requirements of the equipment. The Manufacturer shall supply a chart listing type of lubricant or oil, place used, and corresponding product name and number.

I. Specials:

The Manufacturer shall furnish one (1) complete set of all special tools, new and in first-class condition, which are required for maintenance of the equipment herein specified. Identification of all tools by name and number shall be provided, and this number shall appear on drawings and instructions to indicate the application of the tools furnished and to permit ordering replacements. An itemized list of these tools shall be submitted.

2.3 DRUM CONTAINMENT

- A. Provide one (1) drum container unit Model 5654 as manufactured by the Protectoseal Company or equal.
- B. The containment unit shall be resistant to chemicals and corrosion and be made of HDPE materials.

PART 3 EXECUTION

3.1 TRANSPORTATION

- A. Transport, deliver, and unload all of the above-specified equipment to the job site.

3.2 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations. Installation shall be by others.

3.3 MANUFACTURER'S SERVICES

- A. The Contractor shall furnish the services of a qualified factory-trained serviceman who shall assist during the installation of the separation equipment assembly, check the installation before it is placed into operation, assist with performance of the field tests required, assist with initial operations and instruct the operators on the care, operation, and maintenance of the equipment. A minimum of one (1) day training shall be provided by the manufacturer in addition to the time spent on assistance during installation and startup.

END OF SECTION 11373